

Inside the Search for
Steve Fossett >>>



A Jet You Can
Afford (really) p.28

AIR & SPACE

Smithsonian

**How the
Spitfire
Grabbed
the
Glory**

**Orbital Threat:
Death by Debris**

**Air America's
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Spitfire Mk. V

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MARCH 2008

The Fifth C?

Cut, Color, Carat, Clarity...Chemistry?

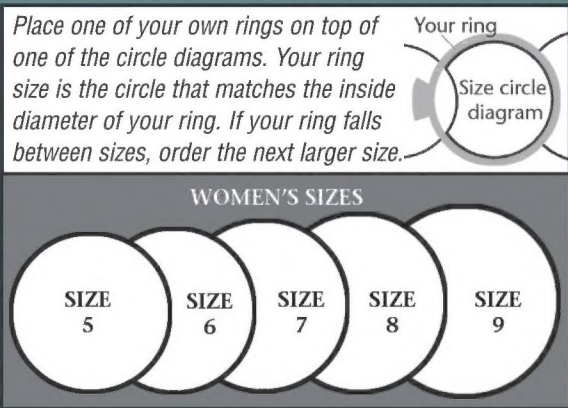
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February/March 2008 | Vol. 22, No. 7

AIR & SPACE

Smithsonian

On the cover: Tom Blair's World War II Spitfire Mk. V, resplendent in the desert camouflage of the North African campaign, preens for the lens of photographer John Dibbs. Historians say the Spitfire legend unfairly eclipses the equal contributions of the Hawker Hurricane (p. 40), but for a cover shot? Spitfire!



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In this corner, the Vickers Supermarine Spitfire; across the ring, the Hawker Hurricane. Which is the more valuable restoration?

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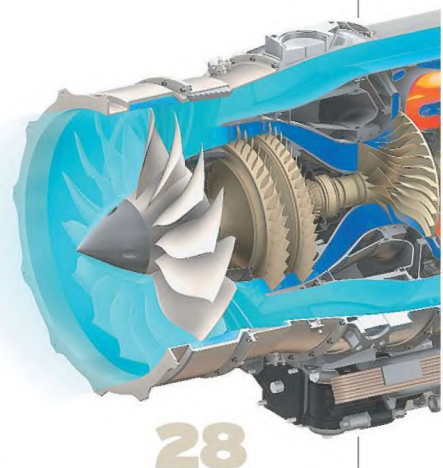
BY MARSHALL LUMSDEN

The man behind—beside, and all over—the Planes of Fame Air Museum.

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BY JAMES R. CHILES

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On the Web Site www.airspacemag.com

Ever hear of the F-19? Four years before the F-117 went public, the model maker Testors created a 1/72 scale of what it thought the F-117 would look like. For the details and more aerospace lore, visit the Web.



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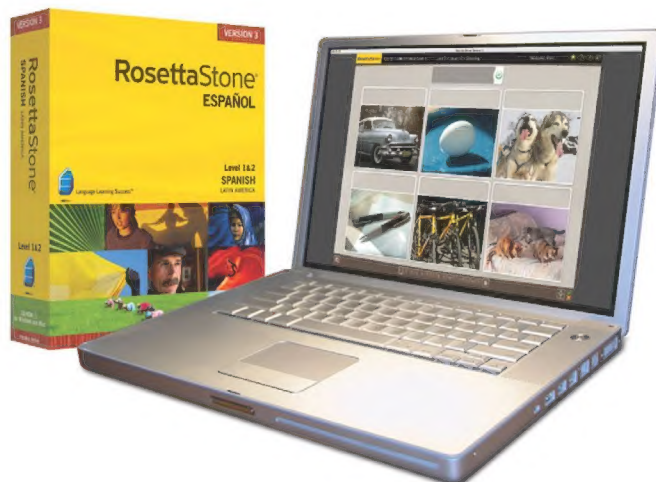


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IF YOU ARE PLANNING to restore a P-51 Mustang, are researching the history of the jet engine, need the specifications for the dive brakes on a Douglas Dauntless, or have a question about an aircraft your father flew in Korea, I encourage you to contact the National Air and Space Museum Archives: www.nasm.si.edu/research/arch/services.cfm

Archivists respond to more than 3,000 requests for information each year from other museums, visiting scholars, restorers, writers, film producers, modelers, government agencies, students, and others curious about aviation history. Inquiries range from the film producer needing historical film footage for a documentary to such questions as "How many golf balls are on the moon?"

The Archives has two million technical drawings, 1,600 cubic feet of technical manuals, 1.7 million photographs, and 700,000 feet of motion picture film, chronicling the history of aviation and spaceflight; it also has the personal papers of such notables as aircraft designer Giuseppe M. Bellanca, aviator Louise Thaden, and General Benjamin O. Davis, Jr., commander of the Tuskegee Airmen.

In addition, the Archives has a collection of scrapbooks that record historic events, such as the National Air Races, and the experiences of individual soldiers and airmen during the two world wars. Our sound recordings capture the voices of Charles and Anne Lindbergh reading from their respective memoirs, *The*

Spirit of St. Louis and *Listen! the Wind*; an interview with Jack Northrop about his flying wing designs; and reflections of Apollo astronauts Gus Grissom, Edward White, and Roger Chaffee on space exploration recorded just one week prior to the launch pad fire that took their lives.

The Archives staff provides information to the Museum's curators and restoration, exhibition, and education departments. For example, during the restoration of the *Enola Gay*, the B-29 that dropped the atomic bomb on Hiroshima, the staff supplied thousands of pages of technical information and drawings. During the project, restorers discovered that the B-29's thousands of specialized nuts and bolts had been stored for years with little or no identification. Archivists and restoration staff spent weeks using the technical manuals to identify each piece and its placement, which enabled the restorers to assemble the *Enola Gay* in time for the Steven F. Udvar-Hazy Center's 2003 dedication. Recently, the team producing the Museum's newest exhibit, "America By Air," made extensive use of the Archives' vast photography and airline ephemera collections.

The Archives staff ensures that valuable historical materials are stored properly and creates finding aids that allow researchers to use the collections effectively. By the way, in case you were wondering, there are two golf balls on the moon.

■ ■ ■ J.R. DAILEY IS THE DIRECTOR OF THE NATIONAL AIR AND SPACE MUSEUM.

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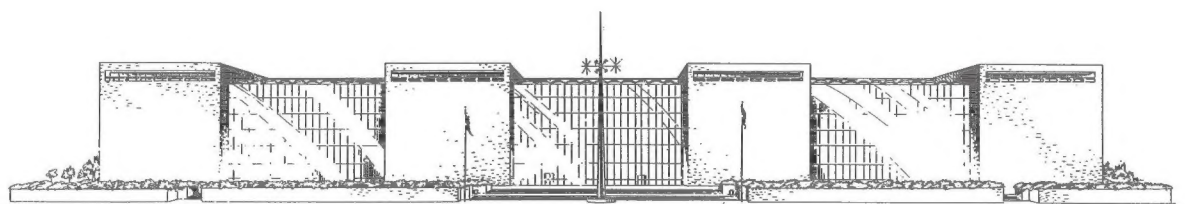
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Phantom Pains

I've been doing a slow burn for some time now.

The cover story for the Dec. 2007/Jan. 2008 issue is on the F-117. The stealth fighter's career does represent an advance in stealth technology, and I suppose that is the rationale for treating the aircraft so loftily—an aircraft that was produced only in small numbers and flown only by the U.S. Air Force.

And before that, in your Aug./Sept. 2006 issue, you published a 22-page cover story salute to the Grumman F-14 Tomcat. An aircraft flown only by one service and one other country: Iran. A fighter jet that has only five aerial combat victories, four of them Libyan aircraft, running away.

I have been a subscriber to your magazine since the inception, and I cannot find a single cover story you have published on the most ubiquitous military fighter jet of the 20th century. A fighter that set records in altitude (two), speed (six), and time to climb (eight). A jet that carried out seven different missions: air-to-air, air-to-ground, nuclear delivery, reconnaissance, close air support, air interdiction, and air defense. It took three new types to replace it (F-15, F-16, and A-10). The only fighter flown simultaneously by the U.S. Air Force, Navy, and Marine Corps, as well as by 11 other nations. The only fighter to fly concurrently with both the Thunderbirds and the Blue Angels. An aircraft that served extensively in

conflicts from Vietnam to Gulf War I. A fighter jet with 280 recorded air-to-air victories.

I am writing of the venerable McDonnell Douglas F-4 Phantom II—lovingly referred to as “the Rhino” by those of us who flew her.

J. Michael Weir
Ballwin, Missouri

Editors' reply: You're right—the F-4 deserves a cover story. Stay tuned.

Feds Okay Flying Car!

“My Other Car Is a Podcopter” (Dec. 2007/Jan. 2008) states that “no drive-fly vehicle designs have ever been submitted to the Federal Aviation Administration for certification.” In fact, Molt Taylor's Aerocar was certified by the Civil Aeronautics Administration, the FAA's forerunner, in 1956.

Samuel W. Clipp
Pennsburg, Pennsylvania

A Hidden Crop

“The Soplatra Airplane Sanctuary” (Oct./Nov. 2007) answered a question I've had for years. I grew up in Warren, Ohio, about 50 miles from Cleveland. During the summer of 1975, while waiting to go on active duty with the Air Force, I heard a rumor about a farm littered with scrapped airplanes. I spent a day searching and eventually found it

and photographed it (left).

I'd always wondered what all those airplanes were doing there.

David Shakley
Ft. Wayne, Indiana

It took a special eye to see historic importance in this pile of wreckage in the Ohio countryside.



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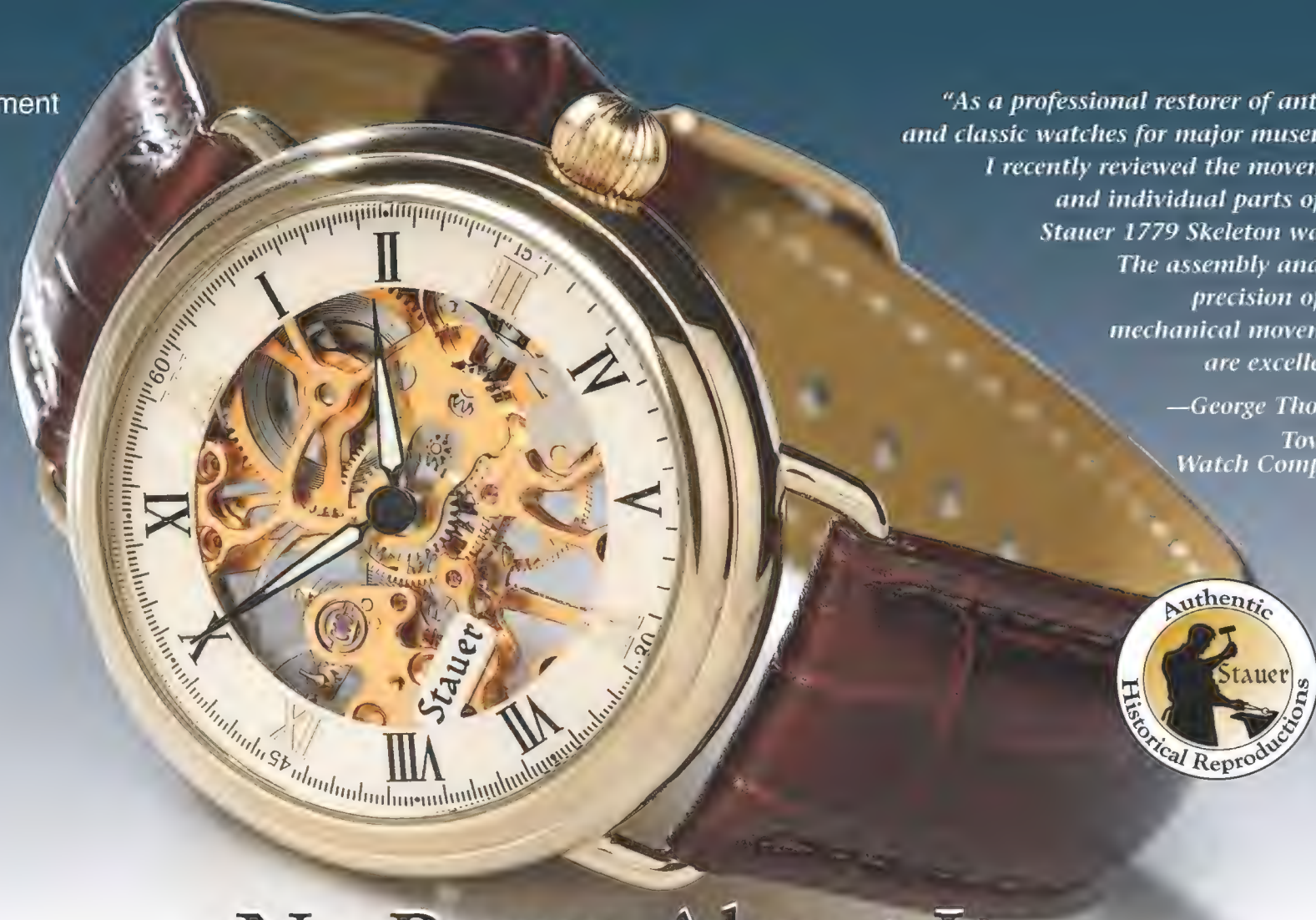
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See All the Way Through. The crystal on the front and the see through exhibition back allow you to observe the gold-fused mainspring, escapement, balance wheel and many of the 17 rubies work in harmony. The balance wheel oscillates at 21,600 times per hour for superb accuracy. The crocodile embossed leather strap adjusts from 6 1/2" to 9" so it will fit practically any wrist. So give it a little wind and the gears roar to life.

The Time Machine. We took the timepiece to George Thomas, a noted historian and watch restorer for major

museums, and he dissected the 110 parts of the vintage movement. He gave the "1779" top reviews. "It is possible to build it better than the original, and your new skeleton requires so little maintenance." When we shared the price with him, George was stunned. He said that no other luxury skeleton can be had for under \$1000. But we pour our money into the watch construction, not into sponsoring yacht races and polo matches. We have been able to keep the price on this collector's limited edition to only three payments of \$33.00. So you can wear a piece of watch making history and still keep

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Letters

First War, Second Triplane

"What the Red Baron Never Knew" (Dec. 2007/Jan. 2008) states that "the only [triplane] to reach the front was the Fokker Dr.I." Although produced in small numbers, the Sopwith Triplane had a short but illustrious career serving Royal Naval Air Service aviators in France in 1917.

Cameron Fraser
Ottawa, Ontario, Canada

dusting biplanes. Within weeks, Nolta had so modified a PT-17 Stearman.

On August 13, 1955, Floyd Nolta's brother Vance dropped water on the Mendenhall fire in the MNF. It was the first official air tanker flight. This technology has since proved incredibly valuable in wildfire suppression.

Bob Fish
Associated Airtanker Pilots
Danville, California

Mantz the Firefighter

"Hollywood's Favorite Pilot" (Oct./Nov. 2007) covers only part of Paul Mantz's legacy. In 1954, federal and state forestry agencies initiated a study to develop comprehensive plans to prevent and control wildfires. Called Operation Firestop, it was headquartered at the Marine Corps base at Camp Pendleton in California and showcased various promising technologies. On one occasion, Paul Mantz placed a rubber bladder in the bomb bay of his World War II TBM Avenger torpedo bomber and filled it with water. Then he flew over the runway and from about 100 feet up, dropped several hundred gallons of the water, drenching a large area below.

Even though Mantz's was an uncontrolled release, it impressed a member of the audience: Joe Ely, the fire control officer for the Mendocino National Forest (MNF) in northern California. As it happened, one of Mantz's part-time movie aviators, Floyd Nolta, also ran the Willows Flying Service in a town bordering the MNF. In June 1955, Ely asked Nolta to develop a water-release gate that could be fitted to the hopper of Nolta's crop-

Right Is Wrong

In "Restoration: Fleet Model 8" (Dec. 2007/Jan. 2008), the first photo on p. 58 shows the McConnell brothers with wings on the right sides of their jackets. The photo must have been printed backward, since all U.S. Army Air Forces wings were to be displayed just above the left breast pocket.

John Anderson
Western Springs, Illinois

Corrections

Dec. 2007/Jan. 2008 "How Things Work: Chandra X-Ray Telescope": An X-ray telescope's mirrors must be facing almost parallel, not perpendicular, to the path of incoming light.

"Out in the Breezy": Lansing Municipal Airport is in Illinois, not Michigan.

Oct./Nov. 2007 "The O Prize": The picture on the left side of p. 40 shows the Walter H. Beech Wind Tunnel at Wichita State University in Kansas.

"Air & Space Interview," Soundings: A statement by Michael Neufeld was misreported. He said: "...in the '60s and '70s, [Wernher von Braun] did express some remorse," not "in his 60s and 70s."

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The Flying Farmer Has Landed

»» ON A PICTURE-PERFECT late October day in rural Bealeton, Virginia, before a hometown crowd of several thousand chanting “CharLIE! CharLIE! CharLIE!” Charlie Kulp, 82, flew his comedy routine, the hapless Flying Farmer Silas Hicks, for the last time. Kulp had been performing the act in his vintage Piper J-3 Cub for 34 years.

In 1971, he and a dozen pilots formed the Flying Circus, a group of barnstormers who sold rides and performed in old biplanes at the grass strip in Bealeton. On Sundays from May through October, hundreds pay the \$10 admission to “relive the Golden Years of flight.”

In his act, Kulp posed as a farmer who had earned his first airplane ride in exchange for mowing the grass strip. In the J-3’s front seat was a ringer pretending to be the pilot; once he got out to examine a supposed problem with the tail, Kulp went to work flying the aircraft from the back, taxiing wildly, then taking off while the announcer cried, “Silas! Silas! Hold on, buddy. We’ll get you out of there.” As the announcer feigned panic, Kulp climbed, dived, and rocked his wings, wallowed around the sky, and



Charlie Kulp (at right) flew his Cub routine at around 200 feet, just a couple of miles per hour above the J-3’s stall speed.



managed to get back down, where he expertly rolled the Cub along the grass on one tire and staggered back into the air.

It takes a lot of skill to pretend to fly badly, though Kulp says, “I just do the same things my students did for years.” He became a flight instructor in 1947, and many of the pilots he taught to fly were among the people cheering for him at his last performance. One former student, retired American Airlines captain Ken Hyde, also a founder of the Flying Circus, recalls working for Kulp in the late 1950s at the old Manassas Airport in Virginia. Hyde, who is also the founder of the Wright Experience, an

organization devoted to recreating the aircraft of the Wright brothers, says that Kulp always had a corps of young people around. “Whether they were picking up trash or working as mechanics, there were always young guys that Charlie was teaching about airplanes. And 90 percent of them” went on to careers in aviation, he said.

Although Kulp is a local hero, he has also flown more than 800 performances in 18 states, Canada, and Britain, and for all of them he has worn the same overalls that he borrowed in 1973 from his late friend and neighbor, the real Silas Hicks.

LINDA SHINER

UPDATE

Cessna Thinks Outside the Chocks

Cessna’s parent company, Textron, announced last November that Cessna had bought Oregon’s Columbia Aircraft, previously known as Lancair (“Cessna’s Golden Oldie,” June/July 2006). Columbia’s advanced single-engine aircraft, Models 350 and 400, will be marketed as the Cessna 350 and 400. Cessna also recently announced that it will turn over production of its SkyCatcher Light Sport Aircraft to China’s Shenyang Aircraft Corporation, in a move to lower the selling price by \$71,000 per aircraft to about \$110,000. Production of the aircraft in China may also make Cessna products more attractive to the growing number of Chinese pilots.

FIND OUT MORE: FOR AN AIR & SPACE INTERVIEW WITH CHARLIE KULP, VISIT www.airspacemag.com

Fast Times at Sikorsky High

>>> "FAST HELICOPTER"

may no longer be an oxymoron. Sikorsky thinks its X2 coaxial-rotor, compound helicopter could dash up to 334 mph, a speed that would make it the world's fastest helicopter (and 18 mph faster than the V-22 Osprey tiltrotor). The current record, 249 mph, was set in 1986 by a heavily modified Westland Lynx.

Most conventional helicopters fly no faster than 200 mph, limited by the main rotor blade's maximum speed and lift and the control available from the tail rotor, which counters main-rotor torque. The X2 features two four-blade composite main rotors mounted one atop the other on a single mast, making them coaxial. They spin in opposite directions, each canceling out the

torque yaw of the other and therefore eliminating the need for a tail rotor. The addition of a six-blade pusher propeller at the end of the tail boom, augmenting the thrust of

coaxial helicopters, which still fly today, for the Russian military. Compared with conventional rotary-wing aircraft, coaxial helicopters are more stable and can lift more because



Sikorsky's X2 coaxial-rotor, compound helicopter won't win any beauty contests, but it will likely win any race it enters.

the main rotors, makes the X2 a compound helicopter.

Working in Italy in 1928, Corridon D'Ascanio designed the first contra-rotating main rotors, and in 1947 N.I. Kamov began designing the Ka series of

no engine power is diverted to a tail rotor, but they weigh more and are more complex to manufacture and maintain.

Compound helicopters have been on the drawing boards since the 1950s, and

some—notably the Lockheed AH-56 Cheyenne of the 1960s—survived to the prototype stage. But a compound helicopter's auxiliary propulsion system also adds weight. Last summer, Piasecki flew its X-49A, a Sikorsky Blackhawk fitted with a tail-mounted, swiveling and ducted propeller for both torque control and additional forward thrust. Its top speed was 230 mph. The system adds 1,600 pounds. Yet even with its composite construction, the X2 weighs in at 6,500 pounds. X2 program manager Peter Grant says weight is not a big concern; the X2 is merely a technology demonstrator for larger future helicopters, such as the Pentagon's proposed Joint Heavy Lift helicopter, designed to replace the tandem-rotor Boeing Chinook.

■ ■ ■ MARK HUBER

WORK IN PROGRESS

Glacier Girl's Welsh Cousin

LAST JULY, A RESIDENT OF WALES strolling the beach found a twin-engine airplane that proved to be a rare Lockheed P-38F. The F was the first P-38 variant to see combat, and Ric Gillespie of The International Group for Historic Aircraft Recovery (TIGHAR) in Wilmington, Delaware, says that there is no F model in original condition in any collection. The newly discovered aircraft, serial no. 41-7677, rolled out of the Lockheed factory within days of *Glacier Girl*, no. 41-7630, which was extracted from 260 feet of Greenland ice in 1992 and rebuilt.

No. 41-7677 crashed in shallow water on the Welsh coast in September 1942 after both engines quit. The pilot walked away from the crash unharmed, and the P-38 was to be salvaged. Because United Kingdom beaches were closed during World War II, most civilians were unaware of the ditched aircraft. At war's end, the beaches were opened, but by then shifting sands had covered the aircraft, and it remained hidden for 65 years.

TIGHAR is working with British museum groups to recover the aircraft for preservation at a United Kingdom museum.

■ ■ ■ PATRICIA TRENNER



Beached Lightning: A rare P-38F, likely the oldest surviving Lightning, recently surfaced on the Welsh shoreline.

Wide Load

>>> THE U.S. AIR FORCE'S C-17 Globemaster III transports everything from troops to ammunition. Last November it added to the mix by hauling an African elephant named Maggie.

A resident of the Alaska Zoo for nearly a quarter-century, Maggie was having increasing difficulty in her chilly concrete habitat. A grassroots campaign convinced zoo officials to move her to a warmer home, the 2,300-acre Ark 2000 wildlife sanctuary in northern California,

*A **Loxodonta africana**, inset, prepares to board a Boeing **Globus-magister tres** in Anchorage for a flight to California.*

operated by the Performing Animal Welfare Society.

No commercial airliners were big enough to hold Maggie, so the society sought help from the Air Force. Last October, Chief of Staff General T. Michael Moseley approved a

mission—Operation Maggie Migration—to carry Maggie aboard a Boeing C-17 at a cost to the society of \$200,000.

After being acquainted with a huge crate, Maggie was transported to Elmendorf Air Force Base, near Anchorage. Air Force personnel moved her on a conveyor belt through the C-17's clamshell doors into the massive cargo bay.

At 8,000 pounds, Maggie weighed a small fraction of the C-17's payload, 170,900 pounds. The aircraft handled as it would with its customary cargo, except when on the ground: "If Maggie rocked back and forth," says Captain Blake Johnson, who led the mission, "you could feel it, like the rocking of a car."

Johnson consulted with Maggie's veterinarian to determine the best cabin pressure and deck angle during takeoff and descent. "We minimized acceleration and deceleration, and flew at 25,000 feet to keep the cabin altitude at 3,000 feet," he says.

After a five-hour flight, the C-17 touched down at Travis Air Force Base in northern California. Maggie's crate went on a flatbed trailer for the drive to the sanctuary, near San Andreas.



Breaking News

AFTER THEIR FAMOUS POWERED

flights at Kitty Hawk, North Carolina, in 1903, the Wright brothers perfected their flying machine on Huffman Prairie near Dayton, Ohio. Many flights – and crashes – resulted in the 1905 Wright Flyer, the world's first practical airplane. On October 5, 1905, Wilbur flew it for more than 39 minutes. The National Park Service marked the 102nd anniversary of the feat with a reenactment flight by Ohioan Mark Dusenberry in his Flyer replica on the same prairie, now a part of Wright-Patterson Air Force Base. Dusenberry spent some 10,000 hours building his historically accurate full-scale replica, which he first flew in 2004. After three days of practice hops, Dusenberry made his Park Service flight. But in his first turn he dragged a wingtip and crashed, reenacting one of the Wright brothers' less glamorous moments. Describing the broken struts and ribs, shattered propellers, and torn fabric, Dusenberry said: "What I broke was a bunch of sticks."



Dusenberry's aircraft is the third Wright Flyer to be the subject of a Federal Aviation Administration crash investigation. Ken Hyde,

of the Wright Experience in Warrenton, Virginia, put his 1911 Wright Model B into a tree in May 2003, and in November had a mishap with his 1903 Flyer. Apparently the projects that reinvent the wheel don't come with reliable instruction manuals.

TIMOTHY R. GAFFNEY

Wright replica aircraft may be simple in design, but not at all simple to fly, as an Ohio pilot recently discovered.



ALLAN T. DUFFIN

TIMOTHY R. GAFFNEY (2)

Orbital Archeology

>>> **AT THE MOMENT,** 10,000 satellites orbit Earth, just 400 of them still functioning. According to archeologist Alice Gorman of Flinders University in Adelaide, Australia, thousands of them have historic significance. Take the U.S. Navy's Vanguard 1, the oldest man-made object up there, which in March 1958 became the fourth satellite in orbit. Gorman, co-chair of the World Archaeological Congress Space Heritage Task Force, wants such objects declared World Heritage Sites. "In the future, the questions we want to ask about the material culture of the Space Age we won't be able to answer," she says, "because we didn't consider these objects' position in history."

Scientists estimate that Earth is orbited by more than 100,000 objects larger than one centimeter (0.4 inch). NASA and the European Space Agency mission planners are studying ground-based and spacecraft-mounted lasers that would nudge junk out of orbit so it burns up in the atmosphere (see "Satellite Smashers," p. 50). Their concern: preventing a smidgen from breaching a shuttle windshield.

The plans are worrisome to preservationists. "I don't think they'd be deliberately hitting Vanguard," Gorman says. But, she adds, those lasers could also nudge old satellites to a safer altitude, where they could orbit until someone was able to return them to their owners.

PHIL SCOTT

Richard Garriott

VIDEO GAME DESIGNER AND PROGRAMMER

LIKE HIS FATHER, SKYLAB AND SHUTTLE astronaut Owen Garriott, 46-year-old Richard Garriott is drawn to space. The computer game developer is paying the Russians \$30 million to take him aboard the International Space Station.

What activities do you have planned for your ISS stay?

One of the first experiments we're taking up is protein crystallization. Time in orbit and an astronaut to operate an experiment is an extremely rare commodity. There is great economic value in microgravity. While computer games have been my voca-



Light on his feet: Richard Garriott practices maneuvering aboard a zero-G Boeing 727.

tion, my private investing has been in exploration and adventure travel with a focus on getting civilians into space. The message we're trying to get out with my flight is that we can provide direct scientific and economic value that makes spaceflight a return on the investment. In partnership with my father and his company, ExtremoZyme, we have taken submarine trips to collect mud from hydrothermal vents, where we've collected extremophile bacteria. We've gene-sequenced and developed protein strains that

have commercial applications. In Antarctica, we've taken ice-core samples to find extremophiles from which we hope also to develop commercial products.

What are the commercial potentials of extremophiles?

Most life we're familiar with lives at one atmosphere of pressure, and in water that is warmer than freezing and below boiling. The creatures near hydrothermal vents live in high pressure and temperature and are anaerobic – no oxygen. Because of that, the microbes themselves, as well as a lot of proteins that you can extract from them, have properties that allow them to function in these unusual conditions. When you're trying to develop, for example, a strain of bacteria that will eat oil that you can scatter onto oil slicks, these kinds of extreme life-forms are very useful.

NASA abandoned protein crystallization research. Why are you pursuing it?

Twenty years ago, protein crystal growth became popular because of the belief that when you crystallize molecules in space, there's no convection currents to cause perturbations in the fluid medium. You get purer crystals. However, you analyzed those crystals with X-ray diffraction, and 20 years ago that imagery couldn't tell much difference between a gravity-born crystal and a microgravity-born crystal. The crystals were bigger and more pure when grown in space, but the practical results weren't that much different to justify the need for microgravity. Today the imagery technology from X-ray crystallography, as well as advances like neutron-beam diffraction, provide much higher resolution, and microgravity appears to provide this advantage.

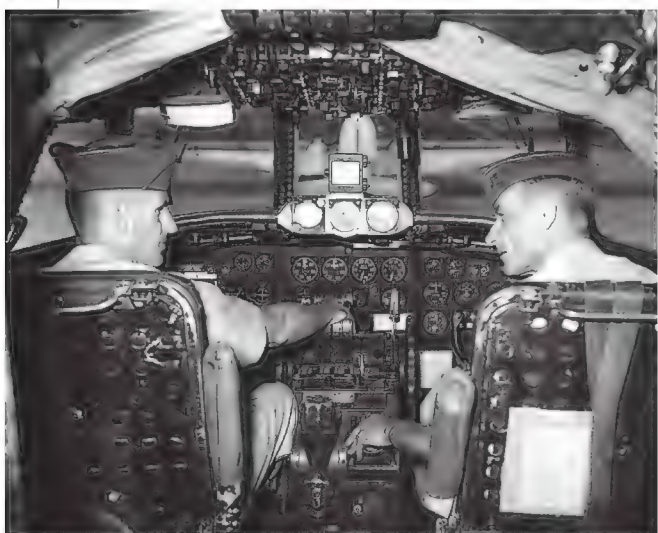
Visit www.airspacemag.com for the full interview.

In the Museum

STOPS ON A TOUR THROUGH AMERICA'S HANGAR

Connie's Comeback

FAMOUS TODAY BECAUSE ITS GREATER speed crushed the competition when it entered service after World War II, the Lockheed Constellation later became the first airliner to fly across the country nonstop—in a mere 8 hours, eastbound. Designed in 1939 by Lockheed aerodynamicist Clarence “Kelly” Johnson and engineer Hall Hibbard to specifications laid out by the not-yet-reclusive Howard Hughes, the Constellation, known as the “Connie,” soon became the ultimate in piston-powered transport. “Up to that



The West Virginia Air National Guard (Richard Davis, left, and Alex Thompson, ca. 1967) flew the Museum's Connie from 1967 to '72. The aircraft was towed to Dulles airport (below) for repainting (top).



time we were sort of ‘small-time guys,’” Hibbard said later. “But when we got to the Constellation we had to be ‘big-time guys’.... We had to be right and we had to be good.” Impressed by the Constellation’s speed, payload, and range—not to mention its distinctive triple-fin tail and dolphin-shaped fuselage—domestic airline companies ordered 89. When Lockheed enlarged the aircraft to accommodate 18 more paying passengers and increase the range even further, the Super Constellation was born.

While the Constellation became famous as an airliner, it first served with distinction in the military. The National Air and Space Museum’s Super Constellation C-121C (the military version of the 1049F) had a long and varied career with the U.S. Air Force and several Air National Guard (ANG) units, remaining in service

from 1956 to 1977. The Museum acquired the aircraft in 1988, and immediately stored it at Washington Dulles International Airport in northern Virginia. In May 2007, Museum specialists, with help from crews from United Airlines and the Metropolitan Washington Airports Authority, towed the airplane from Dulles to the Steven F. Udvar-Hazy Center, where crews removed its badly peeling paint and performed a thorough cleaning. The airplane was then moved into a hangar at Dulles for repainting. “She’s a beauty,” says Karl Heinzl, deputy supervisor of the Museum’s restoration division. “When we’re done with her, she’s gonna look like two million bucks.”

The airplane will be restored to its West Virginia ANG specifications—an easy decision, says Robert van der Linden, chair of the Museum’s



ABOVE & BELOW: DANE PENLAND; OPPOSITE: 167TH RETIREE ASSOCIATION

aeronautics division. “When we restore an airplane, we try to find a representative paint scheme. And some of the folks out at the Metropolitan Washington Airports Authority happened to have been with the West Virginia ANG, and served on this very airplane.”

The Museum’s C-121C was one of 33 delivered to the U.S. Air Force, which assigned it to the 1608th Air Transport Wing at Charleston Air Force Base in South Carolina in 1956. The airplane and its crew participated in the Hungarian airlift of 1957, relocating some 10,000 refugees to the United States, an effort that President Dwight Eisenhower later called the greatest humanitarian airlift in history. It began its ANG service in Mississippi in 1962 and five years later was transferred to the West Virginia ANG and the 167th Military Airlift Squadron. Barry Smith, a navigator with the 167th and now an airport duty manager with the airports authority, recalls seeing the Connie stored at Dulles: “She was sitting on jacks, had no tires or propellers. It was heartbreaking to see the old girl like that. It was like seeing your favorite car in the back yard that you hope to restore getting worse and worse.”

While with the 167th, the aircraft flew supplies and personnel to Vietnam—an 88-hour round trip from Martinsburg, West Virginia—at least twice a month. “We could hold 20,000 pounds of cargo,” says Smith. “Anything you could get through the door, we could haul it.” Eventually, the unit’s C-121Cs were replaced by a fleet of C-130 Hercules transports, a transition witnessed by Smith, who served with the ANG until 1996. “Going from the Connie to the C-130 was like going from a Cadillac to a pickup truck,” he says. “The C-130 was a trash-hauler, while the Connie was just plain luxury. She was beautiful.”

The future of the Museum’s Connie looks bright. “Eventually, we hope to refurbish the interior of the aircraft



Family Days Celebrate African American Pioneers in Aviation on February 9 at the Steven F. Udvar-Hazy Center in northern Virginia, where members of the legendary World War II Tuskegee Airmen will be on hand to tell tales of life in the cockpit. Admission is free; the event runs from 10 a.m. until 3 p.m., and will be repeated on February 23 at the Museum on the National Mall. On March 8, learn about the accomplishments of Bessie Coleman, the Women Air Force Service Pilots, Sally Ride, and more at the Museum’s Women in Aviation & Space Day at the Steven F. Udvar-Hazy Center. The event runs from 10 a.m. to 3 p.m., and admission is free. On March 15, learn about kites – and build your own – at Kites of Asia Day at the National Mall Building. The event runs from 10 a.m. to 3 p.m., and admission is free.



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and bring it back to the exact condition it was when it flew for the West Virginia Air National Guard,” says van der Linden. “We’d like to have a display about the history of the Constellation as a whole, and allow people to actually walk through the airplane—something visitors always request.”

The Constellation—much like its predecessor, the DC-3, and its successor, the Boeing 707—was that rare type of airplane that challenges all of the others in its class to catch up. And now that the Constellation is finally in its rightful place at the Udvar-Hazy Center, visitors can pay tribute.

REBECCA MAKSEL

DANE PENLAND



Dubbed “the Maytag Messerschmitt” due to its excessive vibration, the PT-22A was the Army Air Forces’ first low-wing monoplane primary trainer.

ARTIFACTS

New Recruit

WHILE THE RYAN PT-22 RECRUIT never achieved the sheer numerical force of Stearmans and Fairchilds (Ryan Aeronautical Company had fewer production plants), pilots found the trainer sleeker and more maneuverable than its predecessors. Important as a representation of advances made in military training aircraft during the interwar period, this Recruit was acquired by the Museum in 2005.

Above & Beyond

MEMORABLE FLIGHTS AND OTHER ADVENTURES

Wings? Frail. Engine? Weak. Fly? Let's.

IN 1978, THE SAN DIEGO Aerospace Museum burned to the ground, and afterward, R. L. "Zeke" Cormier, a World War II Hellcat ace and former leader of the Navy's Blue Angels demonstration team, headed up a recovery fundraising effort, which I joined as a volunteer. In short order he rounded up \$1 million—which the museum would get if we could match it with donations from the public. I took on the role of director of a benefit airshow, to be held at Brown Field, a former Navy base in Otay Mesa, just north of the Mexican border.

A year later, the museum was still not open, but a milestone had been reached with the completion of a reproduction *Spirit of St. Louis*. Museum director Owen Clarke told me that the new airframe would fly in the airshow.

This set the theme: If the public could not yet see aviation history in the museum, the San Diego National Air Festival would present aviation history to them. I discreetly inquired of Clarke if his conviction extended to the rest of the growing collection and mentioned that I had a lot of tailwheel time and an airshow demonstration letter. He raised an eyebrow and told me I might find aircraft to include in the show in the museum's basement.

I studied the Moraine Saulnier that George Peppard's character had flown in the movie *The Blue Max*. Though hopelessly obscure, it was modestly aerobatic, so it held promise. There was a Curtiss Robin, which could provide a Wrong-Way Corrigan act, but that would be tacky.

On the way back to the elevator, a distinctive wooden structure atop a pair of huge fine-spoke wheels caught my eye. I made my way around the crates to find an ornate piece of Victorian woodwork, held together by

filigreed metal fittings, with a wooden propeller. A four-cylinder engine was suspended behind the box frame. There was no cowling and not much of a firewall. Trailing back from the woodwork that defined the nose, four wood

longerons with square cross-sections held apart by cross braces and together by wire trusses flowed to a vertical piece to which was attached a tiny rudder. Painted script on the fabric of the rudder read *Blériot*.

The artifact was the fuselage of the design that Frenchman Louis Blériot had flown across the English Channel in 1909. Behind a rack of parts I found two frail wings and what was likely the horizontal tail. On either side of the spindly fuselage was a registration number, N605WB, which indicated that the replica had once been airworthy.

N605WB had been built by Walter Bullock, a Northwest Airlines captain with a penchant for old airplanes. The logbooks for the airplane and the 1940s-era engine were in the documentation file. The museum had acquired the aircraft in trade for a Curtiss JN-4 Jenny.

I pitched Clarke the idea that I fly the replica at the benefit airshow. He agreed—if I could get the Federal Aviation Administration to issue an airworthiness certificate.

A few days later a truck pulled up at my rented hangar at Oceanside Airport and disgorged all the parts we had found that looked like they belonged on a Blériot. What was not found were



As it was in the beginning, is now and ever shall be: When the tail comes up, it's time to take off.

assembly instructions. After comparing old photographs to the wires and parts at hand, it became generally apparent how the thing should go together.

Rigging information was also missing, so I tightened the flying wires to a tension that felt right to keep the wings attached. Building control-line model airplanes had educated me in the value of proper alignment.

An overhaul of the 85-horsepower Continental C85 engine was outside the budget, but cleaning and gapping the spark plugs and running it up sufficed. The engine sounded smooth enough despite the dismal compression readings.

The fabric appeared to have been compromised at the wing's leading edge. Rumor had it that the wings had once been stored against a hangar wall, with the leading edges down, and that the building had later been flooded. Water stains were clearly visible a foot back from the leading edge.

When the FAA inspector arrived, I picked a couple of areas well back from the stains to do the fabric punch

tests. Twice the needle in the spring tension gauge eased up through the red and just entered the yellow before the fabric gave way and a little hole indicated the fabric's failure point. Even the best of the linen was just barely strong enough to be certifiable.

The inspector asked me what the museum planned to do with a 12-month airworthiness certification. The airplane was technically—if marginally—airworthy, but one look at it made you wonder how wise it would be to fly it. I told him we planned three flights at the airshow and that I would be the only pilot. He told me to be careful and signed the certificate of airworthiness.

Once the Blériot had been disassembled, moved to Brown Field, and put back together, airshow preparations kept taking up the time I had hoped to use to get acquainted with the airplane. And so it was that the first time I clambered up to stand on the wooden seat with intent to fly was the first day of the airshow.

Fortunately, the Blériot controls matched the convention for stick and rudder; many early designs did not. The control stick was capped with a small wooden steering wheel. The rudder was operated not by independent pedals but by a single bar that pivoted. The engine control was a knob on the left top longeron of the cockpit. The instrument panel held an oil pressure gauge and a tachometer. On the right was a pair of magneto switches.

I pushed the stick hard to the left to check that the controls were free and clear. I was also checking to see, for the umpteenth time, that they were hooked up correctly. What I could not get used to were the massive ripples in the fabric as the entire wing twisted in response to the control input.

Adjusting my goggles, I reviewed what I had gleaned from the few living pilots who had Blériot time. Let it fly itself off: Don't ask it to do anything it doesn't tell you it is ready to do. Keep the power on during descent and fly it firmly back onto the ground rather

than glide to a flare. Never let the bank get too steep, particularly down low—there's not enough rudder to pull you out of a spiral.

I opened the throttle, pushed the stick full forward, leaned into the blast as if to help the airplane accelerate, and watched as the ground speed gently increased. It was like being in a dream where you run harder and harder to escape and yet cannot go any faster. Eventually, though, the tail lifted lazily from the ground.

With no idea what the airspeed was or what was needed, I held the nose on the ground well past when I thought we should be able to fly. Then, in response to slight back pressure, I got unstuck. I eased off a little back pressure to hold the airplane in level flight, just a few feet off the runway, to let it gather what remaining speed it could. Sitting half out of the fuselage, awash in prop blast, I was exhilarated.

A sudden gust of wind battered the airframe and the right wing went down abruptly. I countered with wing warp and a healthy dose of the tiny rudder. The Blériot rolled firmly to wings-level and I centered the controls. The airplane gently pressed on into the wind as if nothing had happened. In that moment I fell in love with the design. With that stub nose and tiny rudder, it looked like a caricature, but it flew like a real airplane.

The plan had been to do a hop, and commit to full flight only if everything was well. The expanse of runway behind was now longer than the stretch ahead. Eventually I would be

out of options and the decision would be made for me: Fly it around the pattern or hit the power lines at the far end of the field.

The pilot in me urged: Go fly. Show the crowd what a Blériot could really do. The airshow director in me advised caution. The museum was about preserving airplanes, not destroying them. The fabric on the wings was suspect. The engine was weak. And by now my total Blériot time amounted to a mere 20 seconds.

In the most second-guessed decision of my aeronautical career, I eased up on the back pressure. The airplane began a gradual descent. Soon the stability of the ground overcame the buoyancy of flight. The main landing gear was on the ground. Only then did I ease the power back. When the tail finally settled onto the ground and the drag from the dual skids auto-centered the airplane on the ground track, I thanked Louis

Blériot for the way his design benefited the novice.

Zeke Cormier's criterion had been met (I didn't crash), I'd kept my promise to the FAA, and the aftermath of the flight was all good—except the nagging conviction that N605WB could have made a couple of circuits of the field and I could have landed after 10 minutes of self-training. It seemed like an opportunity

missed, a wuss-out in a discipline characterized by bravery. Every time I replayed my momentary re-creation of history, I came to the same decision, but to this day, I wonder: What if?

LARRY LOWE



The airshow poster and program cover featured the Blériot replica (top) literally brushing wingtips with history.

Flights & Fancy

WHIMSY, NOSTALGIA, AND JUST PLAIN MISCHIEF

Thai Boom

ON A DARK NIGHT IN 1971, at 21,000 feet over Laos, a warning light came on in the cockpit of my North American RA-5C Vigilante. A needle dropping to zero on a gauge confirmed the problem. I told my navigator, “Bull, we’ve lost our number-one hydraulic system. We can’t go back to the ship. What’s our heading to Danang?”

As the junior pilot in Navy squadron RVAH-6, I was teamed with an experienced navigator, Bob “Bull” Davis, who was not just senior, but smarter. “Danang has bedbugs and mortar attacks,” he said. “Ubon is the same distance. We’ll go there.” Ubon Ratchathani air base in Thailand was home to the U.S. Air Force Eighth Tactical Fighter Wing, the Wolfpack, which flew F-4 Phantoms.

Next morning, as Bull and I worked to get our airplane repaired, we learned we were celebrities. Ubon was rarely visited by U.S. Navy carrier-based airplanes, and never by a Vigilante. A constant stream of gawkers came to see what, in my opinion, is the best-looking aircraft ever built. That afternoon, the transport bringing mail and personnel to shore landed, delivering mechanics from our USS *Kitty Hawk* squadron.

While they spent the next two days working on our aircraft, we hung with the Wolfpack F-4 Phantom drivers. We spent a lot of time in the officers club and never had to buy a drink. The Phantom pilots asked us repeatedly if we were going to do a flyby when we left. Did they ever do high-speed passes? “Oh sure, all the time,” they said.

On the third day, the Vigilante was declared ready. Parked next to us, loaded with the latest weaponry, was an F-4 being shown to a U.S. Air Force four-star general. We did our walk-around inspection and climbed into our cockpits. When the general had finished looking at the F-4, he walked



over and called up, “Good-looking airplane.” I thanked him, and he wished us a safe flight.

The conversation in our cockpit went something like this: “Well, whaddya think?”

“Sure. Let’s go for it.”

“Ubon tower, 602, request flyby.”

“Roger 602, how low will you go?”

“As low as you’ll let us.”

I lit the afterburners and headed down. The mechanics later said it was spectacular. At the end of the runway I pulled up, did a couple of rolls, and headed back to the *Kitty Hawk*. After that, life settled into routine. For a week.

No words strike fear into a junior officer’s heart like “The skipper wants to see you in his office.” After rapping on the door and hearing a brusque “Enter,” I stood at attention. Commander Bill Belay said, “What the !%#@# did you do in Ubon last week?”

It seems the Thais had stormed the base at Ubon, demanding retribution for windows broken by a sonic boom. The local commanders figured out it was not one of theirs and sent the problem up the Air Force chain of command. In Hawaii, where four-stars talk to four-stars, the Air Force and Navy exchanged information on the

The fearsome Vigilante was meant to carry nuclear weapons but ended up lugging reconnaissance cameras.

incident. From the Navy Commander-in-Chief Pacific, it rolled back down the Naval chain, gaining momentum. For the next eight days I did not know whether I was to be court-martialed, sued, or keelhauled.

Then an officer on the embarked admiral’s staff let me peek at a message from a high level in the Air Force. It was mostly business but it ended with “Good-looking airplane in Ubon a week ago. When’s it coming back?”

I was concerned about my pals back at the Wolfpack. In the Philippines I ran into an F-4 crew from Ubon and asked if my low flyby had led to restrictions on their flying. The pilot looked at me and said, “What flyby?”

I’m convinced that owners of the curio shops, tailor shops, and bars heard my sonic boom and heaved Coke bottles through the nearest window, hoping for money from Uncle Sam. There was likely no damage at all.

I’ve been called Boom for 30 years now. I haven’t given up low passes—I just keep them below Mach 1.

■■■■ R. R. “BOOM” POWELL

COURTESY R. R. POWELL

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ANATOMY OF



"YOU ARE LOOKING FOR SOMETHING THAT DOESN'T BELONG: burned foliage, glinting metal, scorch marks on the ground," explains Cynthia Ryan, who is sitting next to me in our Cessna 182, making notes about our flight on a yellow legal pad.

It is a crisp and cloudless September morning, and I am serving as a "scanner" on this Civil Air Patrol flight. The job is painful: With my face smushed against the rear starboard window, I squint through the blinding morning sun to scrutinize a jumble of craggy peaks, badlands, arroyos, and withering scrub. Ryan points out Mount Grant, an 11,500-foot-high monolith at 10 o'clock, just as the pilot rolls us sideways to avoid hitting it. "That's one son-of-a-gun to search because it's so rugged," she says.

After millionaire adventurer Steve Fossett and his airplane went missing in Nevada on September 3, 2007, it was the Civil Air Patrol that led the search for him. When I arranged to join the hunt, Ryan, 54, a CAP information officer, insisted I wear one of those motion-sickness medication patches you stick behind your ear. I've been jostled in jetliners above South

INSIDE THE HUNT FOR STEVE FOSSETT. SEARCH

by Michael Behar



Pacific typhoons and have roller-coasted over Alaska in brittle Beavers, and I have never once been airsick. But I'm glad I took her advice, because the pilot of our turbo-charged Cessna 182, Ryan's husband Ron, 76, has just made his umpteenth turn 1,000 feet above a cluster of mangy hills that look like crumpled paper grocery bags, and despite my patch, I'm beginning to feel woozy.

Since taking off 45 minutes earlier from Reno-Tahoe International Airport, we've been flying a corkscrew pattern—technically called a “contour search”—slowly descending in 500-foot incre-

What brought down a seasoned pilot like Steve Fossett? Whatever happened, the Civil Air Patrol had to calculate everywhere he could be and divide all that land into searchable sectors. Volunteers then overflew mile after hard-to-read mile.

ments. Thus far, Ron has spent a total of 24 hours in the air looking for Fossett. Now, he's wrestling the yoke to keep sadistic updrafts from kicking our single-engine airplane's butt.

Shortly after Fossett, 63, disappeared in his Bellanca Citabria Super Decathlon, journalists were banned from CAP aircraft involved in the search. “There simply would be no way for us to accommodate everyone,” says Cynthia Ryan. Reporters were drawn by the mysteri-

ous disappearance of a wealthy businessman and aviation celebrity—Fossett had made the first solo, nonstop flight around the world in a balloon; the first solo, nonstop, unrefueled flight around the world in an airplane; and the longest-distance flight of any aircraft in history. He had set a total of 93 aviation world records, and was also an accomplished sailor and mountain climber.

But 24 days had passed since the

OPPOSITE & RIGHT: MICHAEL BEHAR; CENTER: SIMON BAKER/REUTERS

search began, and virtually all the journalists had packed up and left, so it was not hard to talk my way onto a search flight.

The CAP was launching its sorties from command centers in Minden, Nevada, and Bishop, California, primarily in Cessna 172s, 182s, and 206s and Gippsland Airvans—over five states (Nevada, California, Oregon, Utah, and Colorado). Crews from the Air National Guard pitched in—flying low and slow in Kiowa and Pave Hawk helicopters and doing sweeps in C-130 transports with infrared sensors and high-definition video. The Naval Air Station in nearby Fallon, Nevada, sent HH-1N “Huey” helicopters with night-vision goggles. Scuba divers plumbed lakes, and hotel heir and billionaire aviation aficionado Barron Hilton dispatched his own squadron of 10 helicopters and nine fixed-wing aircraft from his Flying M Ranch, where Fossett had departed on his final flight. Search teams ultimately scoured 30,000 square nautical miles—an area the size of Maryland. In some instances, CAP pilots made



MICHAEL BEHAR

The CAP's Nevada wing set up search headquarters at the Minden airport. Many of the patrol's volunteers are retired pilots. Top: John Morgan, who knew Fossett and calls him part of “the brotherhood” of aviators, searches over Minden on Day 10.

two or three passes over the same swath to attain what they say is a 99 percent “probability of detection,” or POD.

Rounding out this effort are my amateur eyeballs (in all likelihood the very last CAP-authorized pair to look for Fossett; the force would stop flights the following day, and suspend the search on October 2). I’m not expecting much

luck. The failure to find Fossett has many speculating on his intent when he took off at 8:45 that morning. It was initially reported that he was scouting for terrain where he could attempt a land speed record in his rocket car. That turned out to be incorrect: He had already found a site. His wife said that he had intended to enjoy a pleasure ride

over the Sierra Nevada mountains, then return for lunch. But what if Fossett had decided to fly one way to some destination? It could mean that there were hundreds and hundreds of miles of land and ocean that had never been searched at all, and needed to be.

AIRPLANES GO MISSING almost daily throughout the country, so you can bet that at any given moment a CAP crew is airborne somewhere. The CAP also helps with immigration enforcement, homeland security operations, drug busts, disaster relief, and ferrying organs for transplants. On 9/11, it was a CAP pilot who snapped the first aerial images of the World Trade Center site.

The Civil Air Patrol was formally established on December 1, 1941, at the behest of Gill Robb Wilson, an aviator



© KIM KOMENICH/SAN FRANCISCO CHRONICLE/CORBIS

and strident proponent of military preparedness. Wilson urged the formation of a civilian air fleet to assist with military operations. Six days later, the Japanese attacked Pearl Harbor (nice timing, Wilson), and the CAP set to work. The volunteers supplied their own aircraft; popular ones included Fairchild 24s, Piper J3s and J4s, and Stinson 10As. In World War II, spotters in CAP aircraft painted red and yellow sighted 173 German submarines prowling America's coastal waters. In *Flying Minute Men*, a history of the CAP, Robert Neprud tells of a German naval officer who was asked after the war why Hitler eventually withdrew his U-boats from U.S. shores. "Because of those damned little red-and-yellow planes," scowled the officer.

Today, the CAP is a nonprofit auxiliary of the U.S. Air Force, which funds

the organization and owns the CAP's fleet of 530 airplanes. There are 1,500 squadrons nationwide (some aircraft are tied to more than one squadron), stationed at 150 locations, "but we could have a base almost anywhere there is a phone and an airstrip," says Cynthia Ryan. "We have to be fast and flexible and have actually, in years past, run searches off of a CAP member's kitchen table."

The CAP operates something like a volunteer fire department: Its 57,000 members—including pilots, scanners, radio communications specialists, ground crews, and office personnel—lurk anonymously in our midst until summoned to duty. Many are retired military and airline pilots who joined the force to keep their skills fresh and to fly for free. At times, volunteers sacrifice weeks of vacation, leaving their jobs to join a search.

Last year, the CAP saved the lives of 105 people. One was Dennis Steinbock, a 53-year-old high school civics teacher from Klamath Falls, Oregon. In June, Steinbock purchased a Zodiac 601XL light sport aircraft in Birmingham, Alabama. He was flying it back to Oregon when at 3,200 feet the engine quit, and the airplane plunged into remote woods southwest of Oxford, Mississippi. The airplane crashed through the trees,

and tried doing all kinds of stuff to get their attention," recalls Steinbock. "I used the lid from an Altoids can, reaching through an opening in the cockpit and flashing it—only I was under 60-foot oak trees and they couldn't see me. But I had a lot of faith in the Civil Air Patrol and was confident they would continue searching."

He was right: With the ELT fix on Steinbock's location, CAP crews launched a ground search. Three volunteers hiked into the woods and found Steinbock. He'd been trapped for 54 hours.

In Nevada, the CAP runs about 30 searches a year. "Of those, only about half turn out to be lost; the others just land and forget to clear out their flight plans," says Gary Derks, an officer for the Nevada Department of Public Safety. Derks is a big portly man with a gentle voice who hates to fly. He's the chief lawman in charge of the Fossett operation, and has been coordinating the efforts of the CAP, National Guard, Navy, and state authorities.

Whenever an airplane goes missing, the initial call from a worried friend or family member typically goes to the FAA, the local police, or an airport flight service (the one at the Reno-Tahoe airport got the call about Fossett at 1:10 p.m., about five and a half hours after he'd departed, from an unidentified fam-

Gary Derks recalls hashing out search strategy the day Fossett disappeared. "It was nighttime," he says, "and there was a possibility of him being trapped in one of the canyons. They're narrow and steep and it's tough to see anything."

ily member). If the airplane disappears in Nevada, the next call is to Derks.

flipped upside down, and left Steinbock pinned in the cockpit with a separated shoulder, a punctured lung, and deep lacerations on both of his legs.

When he didn't close out his flight plan, the Federal Aviation Administration initiated an investigation. Soon after, the CAP's Mississippi Wing went looking for him.

On impact, the Zodiac's emergency locator transmitter (ELT) had automatically begun sending a Mayday signal. Alerted, the CAP aircraft homed in on the beeps. "I heard the planes flying over

ily member). If the airplane disappears in Nevada, the next call is to Derks. "We start by doing ramp checks," he says. Alerts go out to every airport in range of the missing flight to see if the pilot landed and simply forgot to tell anyone he arrived. If that fails, Derks notifies the Air Force Rescue Coordination Center. The center directs all overland search-and-rescue operations in the Lower 48, Mexico, and Canada. When ramp checks turned up nothing after Fossett was reported missing, Derks met with AFRCC brass to hash out the next step.



RICH PEDRONCELLI/AP

Day 5: A Nevada Air National Guard OH-58 Kiowa helicopter lands while a CAP Cessna 182 prepares to take off. Right: ANG's Jeffrey Best searches from a C-130 transport. Opposite: The Wassuk mountains, one of Nevada's 314 ranges – another site that needed searching.

"It was nighttime, and there was a possibility of him being trapped in one of the canyons," Derks recalls. "They're narrow and steep and it's tough to see anything."

The coordination center asked the Navy base in Fallon to conduct a preliminary search with its night-vision Hueys. When that proved unsuccessful, Derks and the center sounded the alarm to mobilize nearby CAP volunteers.

Nevada's CAP ranks include an artist, construction worker, stockbroker, firefighter, realtor, civil engineer, dentist, and lumber salesman. The director of operations for the CAP Nevada Wing is Tim Hahn, a 52-year-old aircraft mechanic and former police lieutenant who had worked on homicides and sex crimes. Hahn has a shaved head and goes by the nickname Kojak. He remembers the first meeting of the CAP volunteers at the command center at the Minden airport, and how daunting the challenges seemed. "Fossett took off in an airplane with four hours of gas," he says. His aircraft could do about 120 knots—nautical miles per hour—so at the outset, the search area was a circle with a radius of either 240 nautical miles (assuming Fossett had been making a round trip) or 480 (if he'd intended to fly one way toward some destination). "In other words," says Hahn, "where do we start?"

At Minden headquarters the walls are covered with aeronautical sectionals—

big topographic maps. On one, crosshairs mark the Flying M Ranch, ringed by concentric circles that indicate the potential ranges of Fossett's journey.

(Later, a ranch hand reported seeing Fossett's aircraft less than 20 miles from the Hilton ranch's airport, at around 11 a.m. By then, Fossett would have had less than two hours of fuel left, so his aircraft would have gone down within the two-hour range. But questions have been raised as to the time of the witness' sighting, and CAP commanders have not been able to interview the man to assess the credibility of his account.)

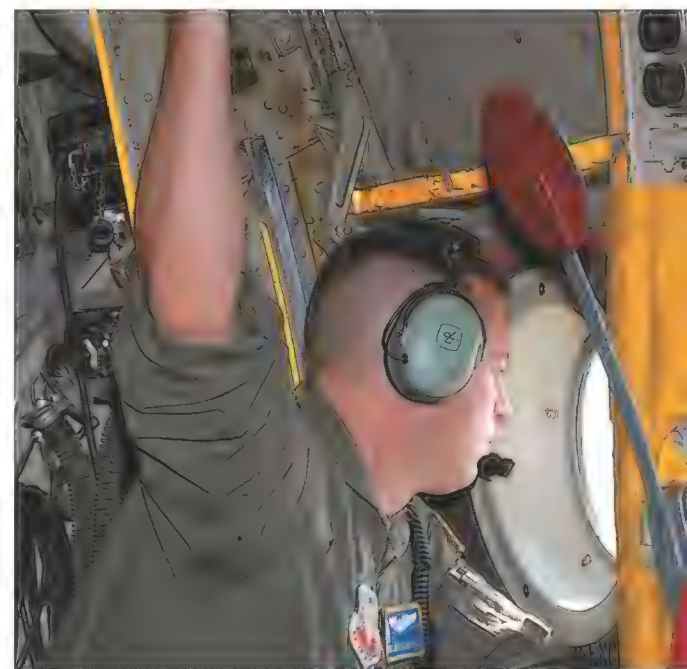
We have stopped here at Minden before our search flight to attend the daily briefing and prepare our flight plan. Uniformed CAP pilots hunch over maps, and the radio in the communications room is cackling with chatter. I meet Betsy Smith, a lanky, fast-talking retired geography professor who warns she'll wring my neck if I print her age. Officially an "incident commander," her CAP duties for the Nevada Wing include overseeing search operations and directing aerospace education.

The maps on the wall are divided into a grid, with each sector encompassing 293 square miles; one of Smith's primary jobs is to assign pilot-scanner teams to the sectors, then keep a tally on which have been flown when and by whom.

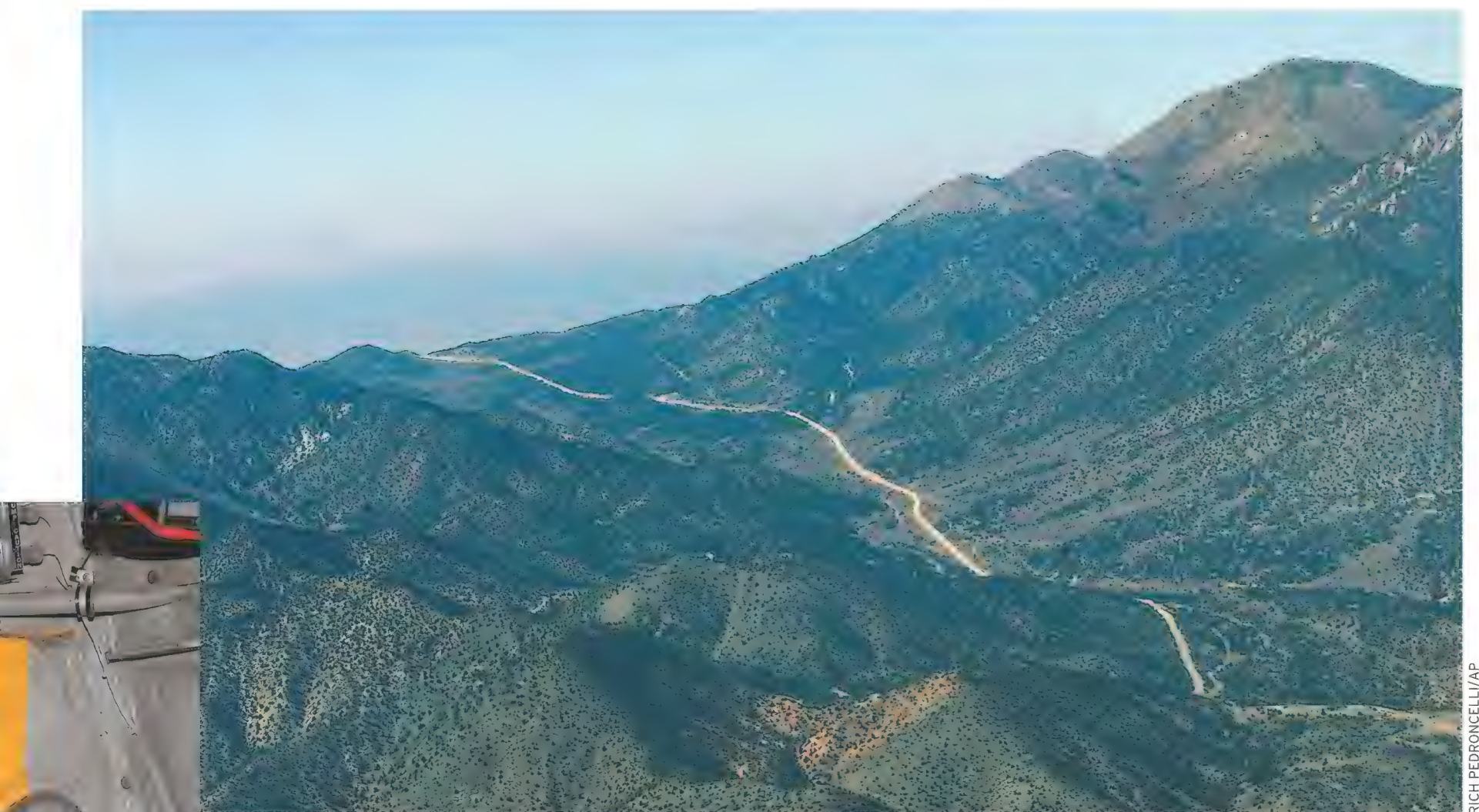
Each time a sector is searched, it's

marked with a purple square. The area running north-south along the eastern slope of the Sierra Nevada range is jammed with purple squares. "This is a region where a small aircraft would encounter very high winds," notes Smith.

Pilot Bill Schroeder, 63, who has just arrived for the morning briefing, says the winds barreling across the Sierras can be deadly to small aircraft and are responsible for the majority of crashes in the state. Schroeder is a master certified flight instructor with a specialty in mountain flying. He tells me that



even expert pilots can easily fall victim to the nasty Sierra winds. "The Sierras are an abrupt outcropping straight out of the ground," he says. "Four miles from Minden they rise 12,000 feet. On the western side of the Sierra, the air follows the slope upward. But as soon as the mountains crest, the air tumbles over the leeward side into Nevada; think of a river flowing over a big rock and then spilling down the backside like a waterfall." When pilots head west toward California, they make a beeline to the mountains, thinking they have ample distance from their departure point—such as the 5,700-foot-long airstrip at Hilton's ranch—to get over the Sierra crest. This might work in the Appalachians, says Schroeder, because those hills slope more gradually, or in the Rockies, where the difference in elevation between the point of takeoff and the Continental Divide is much less. "But here the wind is forced to rise rapidly and can accelerate to well over 130 miles per hour, creating severe downdrafts



RICH PEDRONCELLI/AP

SRA TOM RUSSELL/DOD

on the lee side." Fossett's airplane had a top speed of 155 mph. Even a moderate gust would halve his airspeed almost instantly. "The tumbling air can

turn an aircraft upside down, cause structural damage in flight, and eventually cause a crash," says Schroeder.

WHILE SEARCHING FOR FOSSETT

the Nevada CAP air crews spotted six other wrecks they weren't looking for. "We checked them all out," Derk says. "There were no skeletal remains. We got tail numbers and serial numbers and determined that at some point they had all been identified."

Still, flying over this terrain, you can understand how a wreck might be lying right under your nose but go unnoticed for decades. "People think Nevada is a big flat desert, but it's the most mountainous state in the U.S.," says Cynthia Ryan. Indeed, Nevada encompasses 314 named mountain ranges, and it has more peaks over 10,000 feet than any other state. Though it's the seventh largest state in the nation, it's the eighth least populated, and no wonder: It's a buckled, folded, twisted labyrinth of sheer slopes and jagged volcanic rock.

In this terrain, even a Boeing 747 could disappear.

Think I'm exaggerating? Consider this: United Airlines lets passengers eavesdrop on the pilots' communications with air traffic control. On my flight into Reno, as the Airbus A320 descended, I heard a controller repeatedly ask our pilot to switch on his transponder—a radar transmitter that conveys aircraft identity and location—and the pilot kept insisting it was "operational and working normally." After some back and forth, the voice on the ground finally conceded that the terrain must be blocking the signal. That may explain why pings from Fossett's ELT were never heard.

Riding shotgun on my CAP flight is

Russ Johnson, a 68-year-old retired Air Force pilot. Johnson, a no-nonsense man-of-few-words, isn't entirely enthralled by Fossett's exploits, like his recent interest in setting a land speed record. "I'm not so sure about a guy's judgment when he wants to do 700 miles per hour in his car," he says. Johnson was a forward air controller in Vietnam, a deceptively modest job title for someone who skimmed above the dense jungle in a Cessna, deliberately drawing Viet Cong fire to flush out enemies ahead of advancing U.S. troops. "I have quite a bit of experience looking for stuff on the ground," Johnson tells me. The skill makes him an exceptional CAP scanner: able to remain hyper-focused on mercilessly monotonous terrain as it

Even expert pilots can fall victim to nasty Sierra winds. "The Sierras are an abrupt outcropping," says Bill Schroeder. "They rise 12,000 feet. On the western side, the air follows the slope upward. But as soon as the mountains crest, the air tumbles over the leeward side into Nevada. Think of a river flowing over a big rock and then spilling down the backside like a waterfall."

zips past at 125 mph, while enduring short bursts of overwhelming visual distraction and stress.

During his 33.2 hours of flight time searching for Fossett, Johnson spotted two of those six earlier wreck sites and noted their locations. On this flight, he has decided to show me one of them. He enters the coordinates of one in our Cessna's GPS unit.

We're in a new airplane, built in 2006, with a belly-mounted camera linked to a satellite transmitter, a setup that lets the crew take photos of the ground and send them anywhere in the world instantly. In addition, the Cessna is equipped with a Garmin G1000 "glass cockpit": The instruments are displayed digitally on dual LCD screens in front of the pilot and copilot. The GPS unit is integrated into the glass display, and our route to the wreckage is highlighted in yellow. Johnson pushes a toggle button next to the screen, switching to a "fly through" mode that renders the terrain in three dimensions. The mountains are color-coded, and anything that's higher than our current elevation is red. At the moment, we're flying through a crimson sea.

Only a few Cessnas in the CAP's nationwide fleet have this fancy navigation and imaging technology. But the CAP also has 16 Gippsland Airvans, each with an imaging system called ARCHER (Airborne Real-time Cueing Hyperspectral Enhanced Reconnaissance). ARCHER's prowess is its ability to take a snapshot of an object's color and heat emissions, then compare the data with debris on the ground to try to spot an identical object there. For this search, ARCHER was programmed to use the color and heat signatures of the Super Decathlon's wheel pants, which Fossett had left behind.

The system isn't perfect. "The northern Nevada desert has lots of stuff lying out on it," says Smith. "Trying to determine whether it's old mining junk or a dead airplane—who knows?"

After 15 minutes, our GPS track shows we're about a half-mile from the old wreckage. Johnson takes the controls on his copilot yoke. He banks hard to the left, giving me a clear view of the crash site. According to the GPS unit, we're right on top of it. I crane forward. Cynthia Ryan peers through her win-

dow. Ron Ryan and Johnson glance from side to side, then double-check the coordinates to ensure that we're in the right spot. Despite four sets of eyes trained on a patch of ground less than 900 feet below, none of us can spot the airplane.

Finally, on the fifth pass over the site, I glimpse tiny white specks scattered across a treeless slope. The tail section is partially intact, and from the size of

work and it would break into a million pieces." Plus, the Super Decathlon's fuselage was covered in fabric; if it slammed into a mountain and caught fire, most of that material would burn to ashes. "A couple of tree limbs could cover the wreckage and that would be that," says DeCamp.

"Even if Fossett deliberately set his plane down, because of the terrain, the odds of finding it are minuscule," Derks says.



Would you have spotted it? The writer and the CAP officers with him on his search flight kept missing this old aircraft wreck, one of six uncovered in the course of the Fossett search. The Nevada landscape is cruelly good at concealing wrecks.

it, we figure the airplane is quite large.

It is definitely a lot bigger than Fossett's single-engine, two-seat Bellanca Citabria, "a little bitty airplane that would come apart in a heartbeat," in the words of Dion DeCamp, 73, who commands the CAP Nevada Wing. "You could pull the wings off the thing with your bare hands." DeCamp is a former Air Force C-130 pilot and American Airlines captain. "If Fossett hit anything, the chance of finding the plane is very small because there's not much metal frame-

IT'S SAD TO THINK that Fossett might have walked away from his downed airplane in one piece, only to be killed by the desert heat. Of course, that's just one theory. I hear plenty of others after a round of martinis with CAP pilots at an upscale steakhouse in Reno.

DeCamp is certain the winds did Fossett in: "He stalled the aircraft trying to cross a ridge and went straight into the ground. On the way down he might have snapped a few branches, but most of the limbs sprung back and covered

him up. Eventually, the deer hunters will find him.”

“I had a psychic who called me three times a day, every day, from Ontario,” complains Cynthia Ryan. “He kept insisting that Fossett was up north in the Black Rock Desert near Burning Man [an annual performance-art hippiefest].”

DeCamp bemoans the inundation of tips from people convinced they had single-handedly found Fossett from

Were more search resources directed at Fossett than would have been directed at some run-of-the-mill Wrongway Feldman who flies his airplane into oblivion? Fossett was wealthy and newsworthy; his pal Barron Hilton is an influential political force in Nevada. Was the disappearance given kid-glove handling?



MICHAEL BEHAR

the comfort of their PCs. Shortly after the search started, Google Earth, a database of satellite images, released new images of Nevada, and the online store *amazon.com* provided amateur searchers with a Web site where they could pore over the recent pictures and alert authorities to possible Fossett sightings.

“We got e-mail after e-mail, 30 to 40 images of the same thing with a note saying ‘See attached, here he is,’” laughs DeCamp. “They had taken a satellite picture of one of our airplanes flying over the desert!”

At the peak, CAP was getting up to 500 calls a day. “We heard from people

in China, New Zealand, Belgium, Germany—we got so many calls we had to change the number of the office telephone,” says Smith.

Later, when I’m chatting with Hahn, I ask whether more search resources had been directed at Fossett than would have been directed at some run-of-the-mill Wrongway Feldman who flies his airplane into oblivion. Fossett was wealthy and newsworthy; his pal Barron Hilton is an influential political force in Nevada. Was the case given kid-glove handling? At the peak of the search, more than two dozen aircraft were aloft at one time. “Our fuel bill was \$38,000,” says Cynthia Ryan. “Normal ops for the Nevada wing would be \$8,000 a month.” Total number of CAP search sorties launched: 969.

“Sure, the number of sorties were high,” says Hahn, “but that was due to the area that had to be searched. Because in some places it was so difficult to see anything, we kept putting aircraft back in the air to make certain we were comfortable with the [POD] results in those areas.

“I can honestly say that with Fossett we really did no more, and certainly no less, than we would have for any other search.” Derks echoes that sentiment: “If you took the politics and notoriety out of it, it would be a normal search and the process wouldn’t change.”

It’s a process that can be grueling. Even with the perfect flying conditions for my CAP flight—it’s clear and cool, and the nifty vector indicator shows the air we’re flying through is dead calm—invisible speed bumps give our little Cessna a few hard hits. Trying to keep my gaze fixed on the ground while we’re getting bounced around not only makes me queasy, it also induces what CAP folks call the scanner’s headache.

When we land for lunch in Carson

City, I pop a couple aspirin and down a Coke. I’d been in the air just two hours and I’m embarrassed by my crummy performance and dwindling stamina as a first-time scanner. My head hurts and I’m ready for a nap.

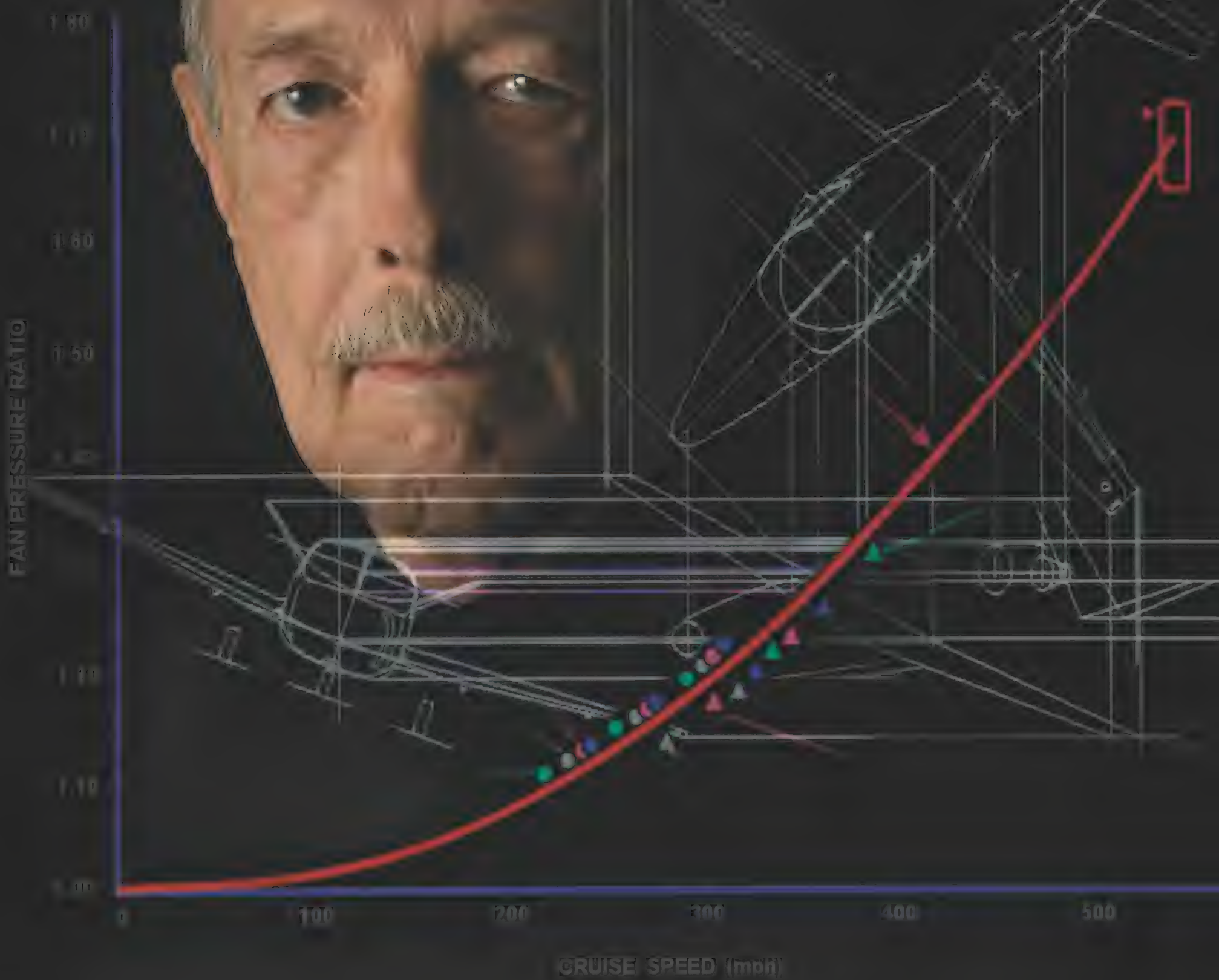
And I’ve gotten away relatively unharmed. Says Hahn: “I’ve come back from search flights where I wake up the next day and I’m black and blue because I got beat up so bad in the airplane, hitting my head and getting slammed against the door.”

This is harsh territory. Fossett was an exceptional pilot who knew how to get himself out of harrowing situations. But somehow the land or the wind or the heat or some combination of these defeated him.

And for all the thousands of miles they’ve searched, some CAP officers believe Fossett isn’t far away. Studies of recent search-and-rescue operations show that the preponderance of crashes occur within a relatively short distance from either end of the runway. “Airplanes don’t often just fall out of the sky en route, when they are at altitude and grinding along,” says Cynthia Ryan. “It’s the takeoff/departure and approach/landing that poses the greatest risk for failure.

“What do we believe in our gut?” she continues. “Fossett is somewhere in a 20- to 25-mile radius of the ranch. He’s there, in a small debris field, obscured by the commonplace of shadow and ground cover or foliage. That’s not glamorous, is it? Not like taking off and just disappearing.” —

On November 26, 2007, Peggy Fossett, Steve’s wife of 38 years, petitioned the Cook County Court in Illinois to have her husband declared dead. “I no longer hold out any hope that Steve has survived,” she wrote.



Who Says a Jet Can't Be Cheap?

NOT GERRY MERRILL. HE FOUND A SURPRISINGLY SIMPLE WAY TO GET MORE MILES PER GALLON. BY DAVID NOLAND

TAPED TO THE WALL of Gerry Merrill's office in Phoenix, Arizona, is a three-view engineering blueprint of a sleek, two-seat personal jet. Finely curved, it sports a V-tail and a single fat engine nacelle atop the rear fuselage. Merrill, a wiry 73-year-old, tells me that, compared to current propeller-driven light airplanes (which he dismisses as "archaic crap"), the airplane on his wall will fly twice as fast, get better fuel mileage, and be 30 times quieter. His proposed family of jet-powered light airplanes, he says, will revolutionize private aviation, if only he can raise the \$120 million it would take to get them certified by the Federal Aviation Administration and into production.

The good news: "This is potentially a multi-billion-dollar business," he says. The bad: He can't break into the market.

Since the 1940s, jet engines have revolutionized military, airline, and corporate flying. But somehow, the jet revolution never trickled down to personal flying.

Gerry Merrill believes his jet-powered Cloudster can be built for the cost of a propeller-driven airplane and, at low speeds and altitudes, can get much better gas mileage than a typical private jet.

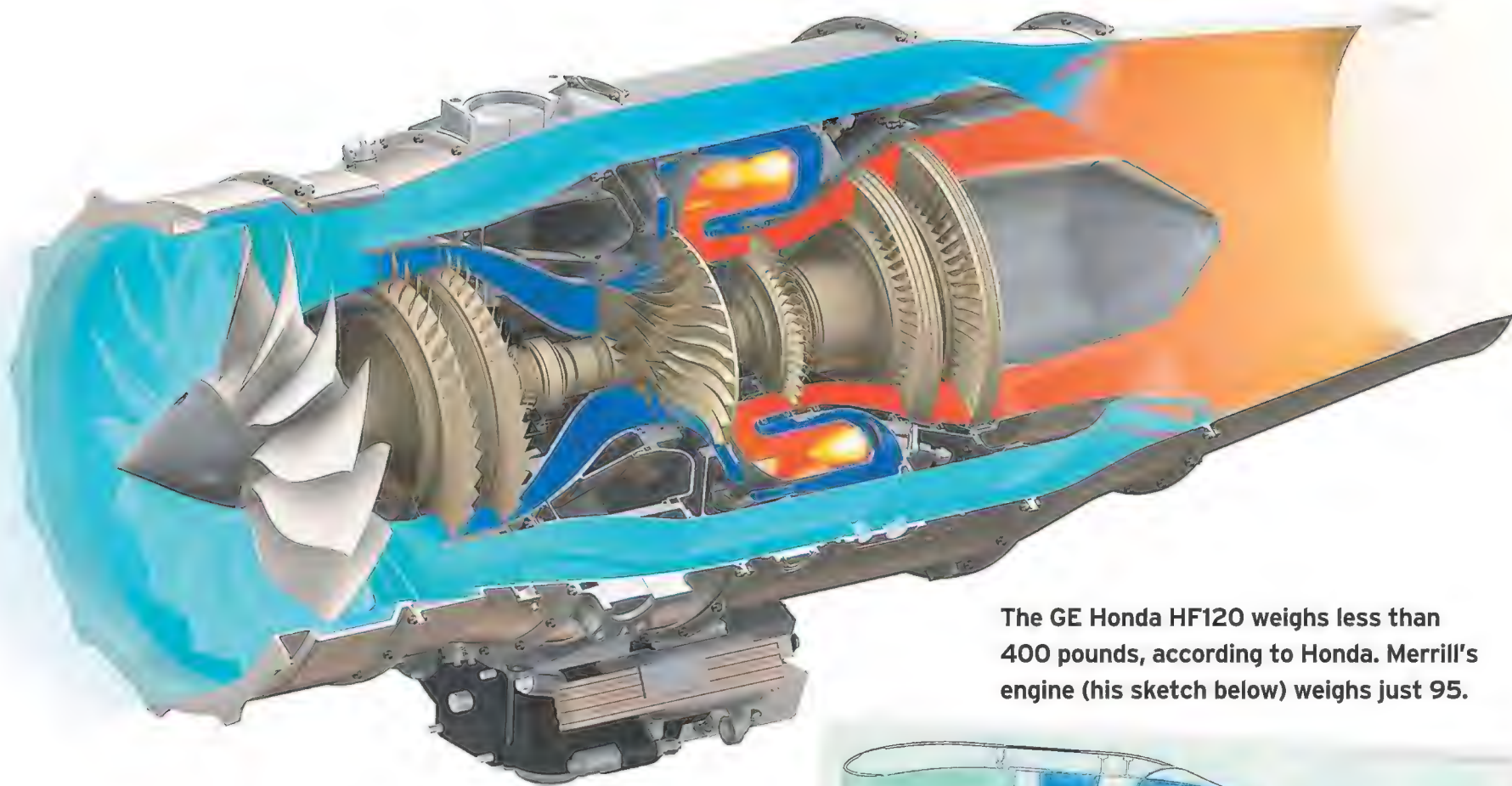
A practical, affordable, jet-powered light airplane for private pilots—a Cessna Skyhawk, say, without the propeller—has for decades been only a dream. Five- or six-seat, \$1.5 million to \$3 million very light jets (VLJs) are just now on the market, but the vision of a single- or double-seat jet with the price tag of a propeller aircraft—one-eighth the cost of a VLJ—has never become more real than three-view drawings taped to the office walls of dreamers everywhere.

But Merrill stands apart from the rest; he probably knows more than anyone about small jet engines. A propulsion industry lifer who has worked on everything from torpedoes to funny-car dragsters, he's had a hand in the design of some 80 jet engines, ranging from the General Electric J79, used in U.S. fighters and bombers in the 1950s and 1960s, to the Teledyne CAE J402, used in today's air-to-surface and cruise missiles. But for more than 40 years, his abiding passion has been the idea of a small jet engine for light aircraft. He has spent most of that time bouncing back and forth between manufacturers, who weren't willing to bet the store on an engine that was not certified, and investors, who wouldn't put up the

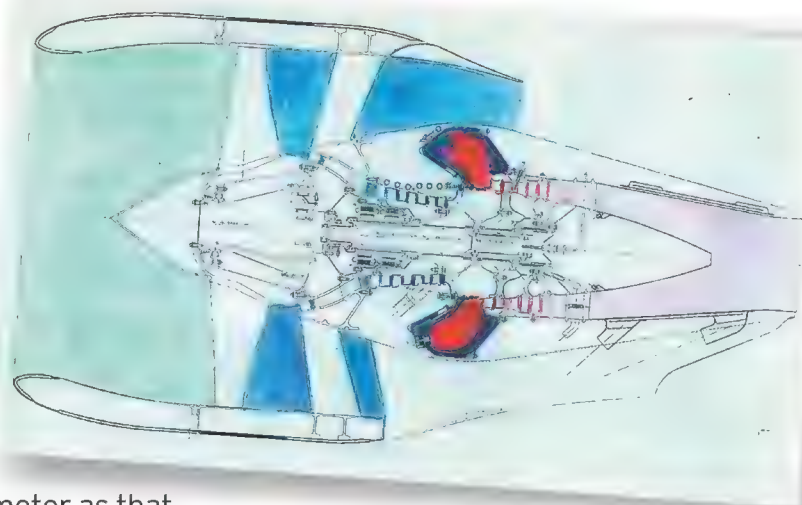
money for certification because the light-airplane market was too unpredictable.

Conventional wisdom holds that jet engines burn too much fuel at low altitudes to be suitable for light aircraft. Jets, it's said, are efficient only above 30,000 feet or so, where light airplanes fear to tread. "That's bullshit," says Merrill flatly. Sure, every jet flying today gulps prodigious amounts of fuel when going low and slow. But that's because they were all designed to run high and fast. The secret, Merrill says, is to simply optimize the configuration of an engine's turbines, compressors, and fan for, say, 250 mph at 15,000 feet instead of 500 mph at 40,000 feet. "It's not rocket science," he says. "My engine technology and materials are basically 1960s. The breakthrough is conceptual."

The results of optimizing a turbofan engine for low and slow are breathtaking—on paper, at least. According to Merrill's numbers, his theoretical 490-pound-thrust turbofan would, at 10,000 feet, push along his theoretical two-seat Cloudster airplane at 270 mph while burning 12 gallons of fuel per hour. That's 22 miles per gallon—about the same fuel efficiency that Cessna claims for its two-seat, propeller-driven 152, which flies not even



The GE Honda HF120 weighs less than 400 pounds, according to Honda. Merrill's engine (his sketch below) weighs just 95.



A Different Kind of Beast

CONVENTIONAL TURBINE ENGINES are optimized for fast, high-altitude flight. The GE Honda HF120 (above) powers the HondaJet, which is designed to cruise at 483 mph and at 43,000 feet. The HF120 produces four times the thrust of Gerry Merrill's design (right), but it also burns fuel at a rate six times that of Merrill's engine, which is designed for much lower speeds (270 mph) and altitudes (10,000 feet). Key to his engine's performance is a 19-inch-diameter fan – almost the same diameter as that on the much larger HF120 (18.5 inches) – which gives it a very low fan pressure ratio and a high fuel efficiency. Merrill's engine measures 30 inches long, while the HF120 is 44 inches.

half as fast. Climb to 23,000 feet, and the Cloudster will do 220 mph while burning seven gallons per hour. That's 31 miles per gallon. So much for the notion that jets at low altitude suck too much fuel, Merrill says.

Two primary factors account for the amazing low-and-slow fuel efficiency of Merrill's turboprops. All have extremely high bypass ratios and very low fan pressure ratios. (The bypass ratio is the amount of the air that passes through the fan—known as “cold thrust”—compared with the amount that passes through the core, or combustion chamber —“hot thrust.” Typically, the higher an engine's bypass ratio, the better its fuel efficiency.) Merrill's engine for the Cloudster on his wall has a bypass ratio of 19, which is five or six times that of the current crop of VLJ engines, and double that of the most advanced jetliner turboprops. Merrill calcu-

lates a specific fuel consumption of around 0.30 pound per hour per pound of thrust—an extraordinarily low number, and one that is 50 percent better than the current VLJ mainstay engines, the Williams FJ33 and the Pratt & Whitney PW600 series.

But the real breakthrough in Merrill's engines is in their low fan pressure ratios. The ratio of pressures across the fan stage is a rough indicator of how much kinetic energy is wasted as air passes through the fan. “You've got to match the fan pressure ratio to the airspeed,” says Merrill. “The lower the speed, the lower the FPR.” Merrill is cagey about disclosing his engines' precise fan pressure ratio, but claims it is much lower than that on the VLJ engines.

Merrill estimates the cost of a production engine at \$44,000, about the same as the price of current piston engines of similar power. But the estimate is dependent

on a production run in the thousands.

The other aircraft in the Merrill line have similarly surprising numbers. A four-seater powered by an 800-pound-thrust engine could hit 280 mph, and get up to 22 mpg. That's better fuel economy than current four-seat prop airplanes, which fly 100 mph slower. Merrill figures such an airplane, once in large-scale production, would cost about \$450,000, roughly the same as a current Cirrus SR22-GTS four-seater. He estimates that his single-seater, weighing just 320 pounds empty, would cruise at 220 mph, get 55 mpg, and cost just \$150,000.

Emmett Kraus, a retired manager of advanced design at Cessna, thinks Merrill's calculations are more than just wishful thinking. “He knows what works and what doesn't,” says Kraus. “His program makes a lot of sense. I've studied his performance and pricing claims, and I think they're pretty reasonable. With all his hands-on experience in the industry, he's in a better position than most startups to

accurately predict his prices. By far.”

His slick airplane designs notwithstanding, Merrill’s engines alone would seem to have the potential to revolutionize personal flying. It’s an industry axiom that engines beget airplanes, and history suggests that if Merrill can ever get the engine built, the airframe makers will come, in droves. For the past 35 years, every time the jet engine bar has been lowered, the smaller, cheaper jet that results quickly becomes the fastest-selling ever. In 1971, it was the Pratt & Whitney JT15D and the Cessna Citation. In 1993, it was the Williams FJ44 and the CitationJet. Today, it’s the Pratt & Whitney 610 and the Eclipse 500.

As a kid growing up in Michigan during World War II, Merrill was obsessed with aviation. At age 12, his design for a 50-passenger turboprop won a prize from *Air Trails* magazine. Mesmerized by a Lockheed P-80 Shooting Star at a post-war airshow, he decided he’d rather help create fantastic jet airplanes than fly them.

Merrill was hired by General Electric right out of high school, and went to work as a draftsman in the engine development department. At night he attended the University of Cincinnati, and by day he worked on the GOL1590, a prototype jet fighter engine that spawned the J79, which powered the F-104 Starfighter, F-4 Phantom, B-58 Hustler, and A-5 Vigilante. Then

came gigs at Chrysler, Curtiss-Wright, and Smith-Morris, a jet engine component supplier. In 1963, he took a job as a senior design engineer at Teledyne CAE, at the time the leading U.S. manufacturer of small jet engines. He and Tom Foster, a designer who’d been a student of jet propulsion pioneer Frank Whittle in England, became Teledyne’s preliminary design department.

It was here that Merrill first launched his quixotic quest to create a small turbofan for private airplanes—and where he first felt the sting of rejection and betrayal. In 1966, Foster and Merrill started work on a small general aviation jet engine. Their design for a 1,300-pound-thrust turbofan with a bypass ratio of 3:1 was a radical departure from the general aviation jet engines of the day—noisy, fuel-hungry turbojets with around 3,000 pounds of thrust. When Foster and Merrill first pitched their idea for a quiet, fuel-efficient turbofan to Cessna, the company was interested. But Cessna president Dwayne Wallace kept asking for more power, Merrill says, and the proposed Teledyne engine eventually grew to 2,100 pounds.

But then, according to Richard A. Leyes’ book, *The History of North American Small Gas Turbine Aircraft Engines*, “Wallace...called Bill Gwinn, president of United Aircraft Corp., explaining that

Cessna wanted to build a small jet, and that they wanted a Pratt & Whitney engine on it. Gwinn then called Pratt & Whitney Canada president Thor Stevenson, and the next day P&WC engineers were designing their first fanjet engine.”

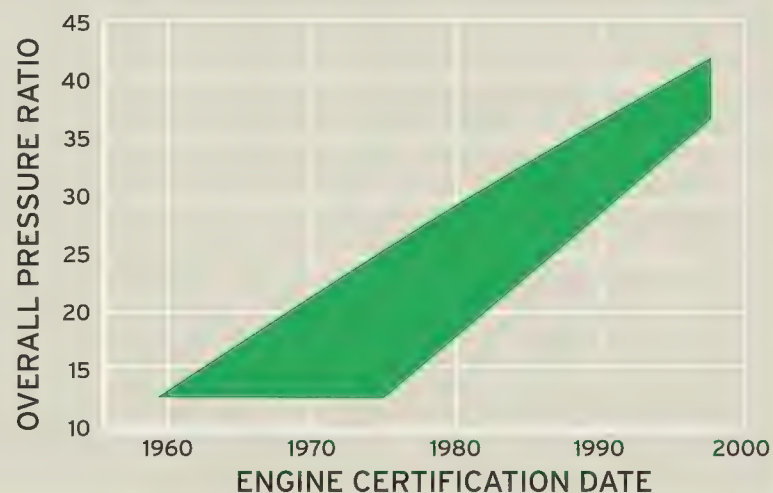
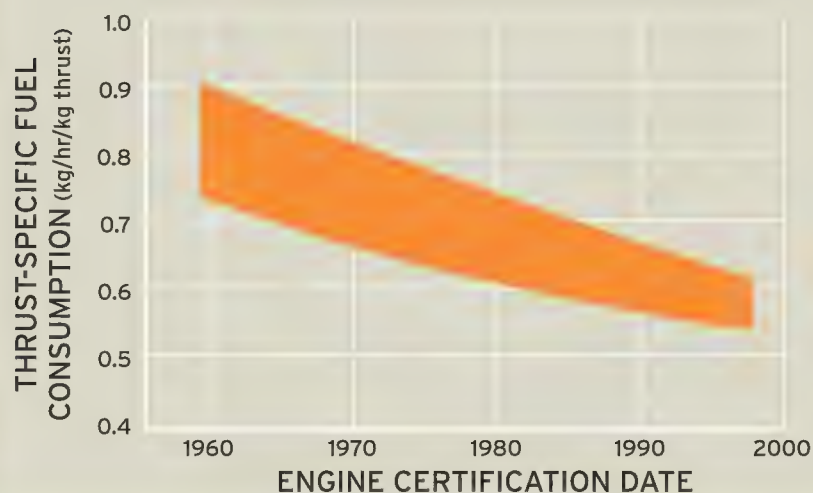
“Wallace wanted a screaming eagle logo on the nacelle,” Merrill says bitterly, referring to the Pratt & Whitney logo. “So he passed on the specs of our engine to Pratt & Whitney.” Whatever the case, in 1969 Pratt & Whitney delivered to Cessna the first JT15D, a 2,200-pound-thrust turbofan with a bypass ratio of about 3:1. Cessna used it to power its new Citation 500, which quickly became the world’s best-selling business jet. The JT15D is still in production today.

The pattern for Merrill’s coming decades of frustration was beginning to take form: Good idea, but no cigar.

In 1971, Merrill moved from Teledyne to Garrett AiResearch’s advanced technology office. One of his projects was a refinement of the original Teledyne concept, a 1,300-pound-thrust turbofan. He offered it to Cessna for a downsized version of the Citation. Then-CEO Mal Harned turned down the idea, choosing instead to proceed with the ill-fated Conquest turboprop. Thirty-six years later, Cessna introduced the Mustang, a downsized version of the Citation with 1,300-pound-thrust

Better Engines Curb the Gas Guzzling

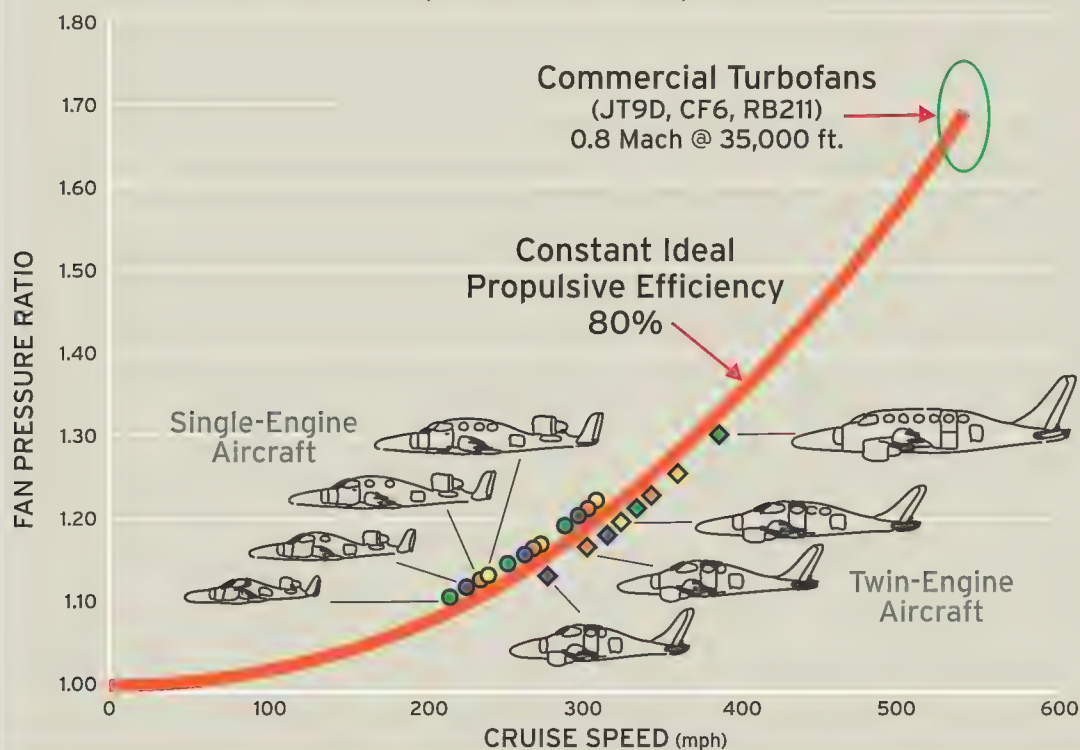
JET AIRCRAFT ENGINES HAVE BECOME MORE fuel-efficient over the past four decades. From 1960 to 1970, turbojets and first-generation turbofans gulped relatively high levels of fuel at cruising speed (left chart). From 1970 to the mid-1980s, second-generation turbofans were developed that had significantly better fuel efficiency than their predecessors. Today’s third-generation engines are better still. A big reason why is that over the years, engineers have been able to increase the overall pressure ratio of jet engines (right chart). The higher pressures within the chambers of an engine allow fuel to be burned more efficiently, thereby boosting gas mileage, according to the Intergovernmental Panel on Climate Change.



INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

The 80 Percent Solution

Merrill used this chart to show investors that because his jets have low fan pressures, they operate along the same line of ideal performance as commercial turbofans, but at lower cruise speeds. The lower speeds translate into fuel savings.



Pratt & Whitney engines.

Merrill left Garrett in 1984 to pursue his vision of a practical light-airplane turbofan on his own. For the next three years, under the auspices of his contract engineering firm, Advanced Propulsion Inc., Merrill peddled his ideas to virtually every general aviation airframe maker in North America. He got nowhere. The light airplane industry was then in a state of virtual collapse, and “they were too busy just trying to survive,” Merrill says.

Working with old industry friends, Merrill designed a family of small jet aircraft around his engine concept, ranging from a 260-mph single-seater weighing just 760 pounds to a 10-seat executive jet. He called the project Private Jets.

In 1991, a friend introduced Merrill to Donald Douglas Jr., son of the Douglas Aircraft founder. Then 75 and retired from 20 years in the executive suite of the family business, the gruff, no-nonsense Douglas listened intently to Merrill’s 45-minute pitch. “He got it immediately,” recalls Merrill. A few weeks later, Douglas agreed to use his name and industry contacts to help Merrill raise money. The company was renamed Douglas Private Jets.

Douglas set up meetings with a number of old buddies. There were some tantalizing negotiations, but once again, nothing came of them. Increasingly frustrated

with the turndowns, Merrill and Douglas drew up a plan in 1993 to tap a new source: the U.S. government. That June, they gave a two-day briefing to engineers and managers at NASA’s Lewis (since renamed Glenn) Research Center in Cleveland. Nice presentation, they were told, but no money available there. Undeterred, the pair went to Washington, D.C., and started knocking on doors. After two years of pleading that included audiences with NASA chief Dan Goldin and FAA boss David Hinson, Merrill and Douglas pulled off what appeared to be a stunning victo-

ry: Congress appropriated \$37.25 million for a NASA research program based on their Private Jets concept.

The research effort was assigned to the Lewis center and renamed the General Aviation Powerplant, or GAP, program. According to a NASA press release with hyperbole matching that of the flip charts Merrill showed potential investors, GAP’s goal was to “reduce the cost of small turbine engines by a factor of 10 and revolutionize the concept of personal air transportation.” Just one catch: GAP was to be opened up to bids from the industry. Suddenly Merrill was going up against the big boys again. And there was another problem: Goldin’s philosophy that the agency should take care of its “customers”—the established engine manufacturers that it had been working with for years.

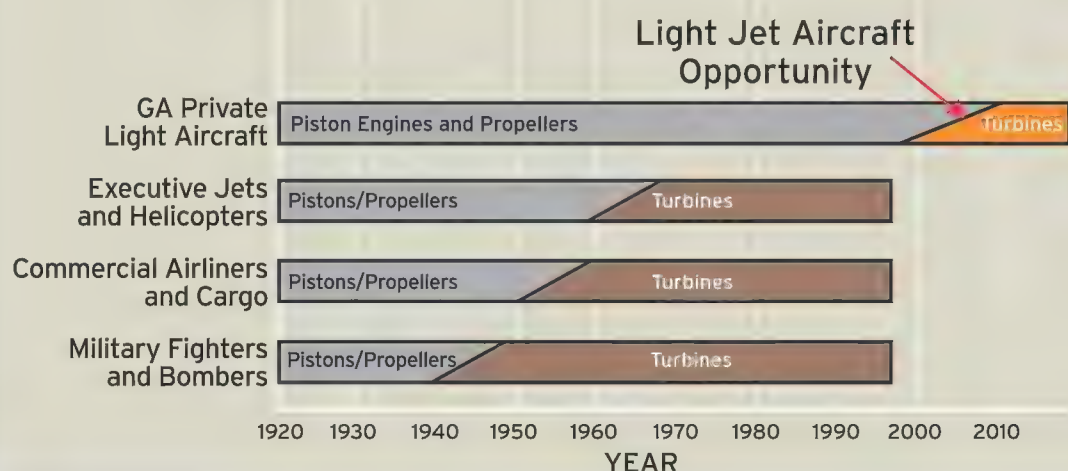
Merrill tried to partner with several manufacturers, but in the end, Douglas Private Jets went it alone. Williams International won the GAP contract with its FJX2, a cutting-edge turbofan that worked fine in the test cell but flopped when the company tried to turn it into an engine for the Eclipse 500. It has since disappeared (see “The Little Engine That Couldn’t,” Oct./Nov. 2005).

“NASA stabbed us in the back,” says Merrill. “Instead of an engine for a 200-knot, 20,000-foot lightplane like we proposed, they ended up with an engine for a small business jet that cruised at 41,000 feet. Even if it had worked, it wouldn’t have revolutionized a damn thing.”

Sour grapes? NASA’s Leo Burkhardt, the GAP program manager, confirms Mer-

A Long Transition to Turbines

A chart by Merrill illustrates that general aviation has been a latecomer in the transition from piston engines to turbines. The orange band represents his vision of an affordable, lightweight, fuel-efficient jet’s business potential.



INSET: COURTESY ADVANCED PROPULSION INC. (2)



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rill's role in getting the GAP ball rolling. "Gerry's advocacy opened our eyes to the potential of small turbfans," he says. "Gerry made it happen. I give him total credit for that." Burkhardt says he considered Merrill's proposal technically feasible but felt that Williams' design was more advanced. "Of course it was more advanced," retorts Merrill. "That's why it failed. The whole point of our engine was that it was all proven technology, but optimized for the low-and-slow regime."

Don Douglas died in 2004, and Merrill has carried on with occasional help from Douglas' younger brother Jim and other industry friends. He still gives presentations now and then at the Experimental Aircraft Association's annual fly-in at Oshkosh, Wisconsin, and is currently targeting a potential investor in the Persian Gulf. Although Merrill's enthusiasm for his crusade shows no signs of spooling down, he seems resigned to his 40 years of failure. "People get interested, but everywhere you turn, the capital always seems to be committed to other projects," he says. "To people with money, we're just bothersome pissants."

Bruce Holmes, the cerebral former NASA general aviation soothsayer, puts it a bit more delicately. "It comes down to the investment culture these days," he says. "Going from slow little planes to fast little planes really changes the

paradigm. That's too unpredictable for most investors."

That's because most investors are cautious by nature, says Richard Aboulafia, an analyst for the Teal Group, an aerospace investment consulting firm in Fairfax, Virginia. "Investors are willing to underwrite incremental improvements, but not great leaps forward like Merrill's," he says. "The [market is] too unpredictable, and that scares them off. You need slam-dunk numbers to attract money, and investors don't see that kind of potential in the light-plane market. They want to see numbers like the bizjet market, which has more than quadrupled in the past decade."

Another problem for Merrill, Aboulafia says, is that "he's a small startup company. The history of this business is that the big guy wins. An investor would be very leery of putting money into a small company with a new engine technology like this, only to watch Pratt & Whitney come along and take over the market."

Even the newer, more visionary aviation companies seem wary. "It's ingrained in our core, our company culture, that the engine has to be there, certified and

Merrill's dream is to get his Cloudster airplane into production. But the problem, he says, is "the industry at large hasn't been interested in airplanes of this kind."

proven," says Mike Van Staagen, vice president of advanced development for Cirrus Design. Cirrus recently unveiled a mockup of a single-engine personal jet, but it will use a standard high-and-fast Williams FJ33 engine. "We closed the door on Merrill because it was just too big a leap. To hinge the entire company on an unproven engine is just something we're not willing to do."

With their V-tails and top-mounted single nacelles, both the Cirrus mockup and Eclipse Aviation's new single-engine, four-seat Concept Jet, introduced with much fanfare at last year's Oshkosh show, look to be straight out of the Merrill playbook. Underneath the skin, though, the new Eclipse is still a 400-mph, 41,000-foot, million-dollar machine powered by a high-and-fast turboprop. Merrill's low-and-slow market niche remains wide open, waiting to be filled by somebody with enough money and vision. ✈

FIND OUT MORE

www.airspacemag.com

FOR A LOOK AT SOME PREVIOUS ATTEMPTS to build and market personal jets, visit www.airspacemag.com.



Maybe one day people about to make a quick jaunt into space will be able to pick out an appropriate outfit at the local Nordstrom or Gap. In the meantime, several companies are brainstorming ways to dress passengers on the first tourist craft. Some efforts are practical, based on sound aerospace engineering, while others are in the realm of couture: more a matter of making an aesthetic statement.

A dramatic example of the latter debuted in November 2006, when a woman strode down the runway of a fashion show in Tokyo wearing a dress that looked like a giant upside-down shredded coffee filter. "The idea was that when you're in zero gravity, the thin, sheer fabric will float," says Chuck Lauer, vice president of business development for Rocketplane Global, Inc., an Oklahoma City company that hopes to offer suborbital tourist spaceflights in its Rocketplane XP, which will take off and land like a conventional aircraft (see "The O Prize," Oct./Nov. 2007).

The dress was one of the unusual creations on parade at the Hyper Space Couture Design Contest, which was born when Misuzu Onuki, Rocketplane's director of Asian business development, asked a simple question. "The only thing we've thought about from a clothing standpoint was, well, everyone wears blue flightsuits," says Lauer. "Misuzu asked, 'Do you have to wear that?' I hadn't thought about it before. It literally came from that."

Onuki organized the contest with Japanese fashion designer Eri Matsui. Entrants—there were about 1,000—provided sketches of their designs. The final runway show featured the 11 best. "The president of the Japan Aerospace Exploration Agency was a judge," says Lauer. "It was like having [NASA Administrator] Mike Griffin judge a fashion contest."

The winner, Midori Umetsu, had created matching mother-daughter space outfits. She is now working with Rocketplane to produce her design for the company's customers. "[Her outfit] will have to satisfy some fairly demanding technical requirements," says Lauer. "It will have to be flame-resistant and

ERI MATSUI



Fashion

Smart styles for space tourists. BY BETTINA H. CHAVANNE

practical enough not to interfere with seat belts, seating, or emergency egress."

The leader of the commercial space race, Richard Branson's Virgin Galactic, is less forthcoming; the company would not comment on suit designs for its *SpaceShipTwo* passengers; nor would superstar designer Philippe Starck, who is consulting with the company on early sketches. In an e-mail sent by his public relations team, Starck says only that his new spacesuit "reflects the emotions the Virgin Galactic astronauts will experience."

The designers at Orbital Outfitters, a company devoted to producing suits for space tourists, are also interested in getting the look right. Explains founder Rick Tumlinson: "We have what we call

the Dude Ranch effect. When you go to a dude ranch, you don't just want to look like a cowboy. You want to look like John Wayne playing the part of a cowboy."

Still, the company isn't neglecting the engineering. Tumlinson has partnered with Bill Stone, an underwater cave diver who will contribute his expertise to creating self-contained life support systems; Chris Gilman, a renowned movie special effects and costume designer known for his spacesuit replicas; and John Clark, a flight surgeon and survivability expert.

Orbital Outfitters is designing loose, comfortable suits with headgear that may, in future designs, incorporate an iPod and a visual recording device so the tourist can tape the spaceflight experience. Sensors in the suits will measure data like temperature and broadcast the information so the flight crew can monitor passenger safety. And the company is considering slenderizing panels around the waist. (Let's face it—when people pay \$200,000 and up to float around in a spacecraft, they don't want to look fat in the pictures.)

For emergencies, Orbital Outfitters is designing two kinds of suits: The IVA—intra-vehicular activities—suit would activate if cabin pressure is lost, providing the passenger with a safe, pressurized micro-environment, while the EVA (extra-vehicular activities) suit would be used if the passengers needed to exit the spacecraft. Other companies, anticipating possible EVA scenarios, have requested suits with parachutes.

Each spaceflight company has different suit requirements (and color schemes). "XCOR's flight experience involves a certain set of activities that Rocketplane's doesn't," says Tumlinson. "Some companies won't have people leaving their seats or floating around at apogee [the highest point in the flight]."

And thus the need for a giant upside-down shredded coffee filter. If you can't float around the cabin, at least your clothes can. ➤

Opposite: "Will you take this space-woman...?" A bridal gown designed for maximum poofiness in zero-G is part of Rocketplane's high-drama plan to conduct a wedding during its first commercial space-flight.

More down-to-earth: Orbital Outfitters developed the pressurized polyurethane suit at left for XCOR.

The outfit above emerged from a 2006 Stockholm workshop in which designers fashioned fanciful space outfits out of materials like bubble wrap and rubber, then staged a photo shoot.



ORBITAL OUTFITTERS

America

THE CRUISABLE

THE MOTHER OF ALL FLYING BOATS BY THE FATHER OF NAVAL AVIATION.
STORY AND PHOTOGRAPHS BY JAMES WYNBRANDT



JAMES WYNBRANDT

FOR AVIATION PIONEER GLENN CURTISS, the Finger Lakes region of upstate New York held a special appeal. “Curtiss was fascinated with getting off the water,” says Trafford Doherty, executive director of the Glenn H. Curtiss Museum in Hammondsport, Curtiss’ hometown, located at the south end of Keuka (pronounced “CUE-ka”) Lake. In 1908, there were no airports, so an aircraft that could take off from and land on water would be far more versatile than a land-based airplane.

Doherty, a former pilot and production control specialist for the Schweizer Aircraft Corporation in nearby Elmira, is a genial tour guide. As he prepares the museum for a banquet celebrating the fifth annual Seaplane Homecoming Weekend, he points out artifacts and exhibits attesting to Curtiss’ inventive genius: bicycles, motorcycles, engines, a house trailer, and of

course airplanes, from an early “pusher” (with the propeller facing the rear of the aircraft) through the famous JN “Jenny” series to later models, including an Oriole and a Robin.

By 1911, when Curtiss perfected the technology needed for seaplane operations, he had already earned the title “Fastest Man on Earth” by powering a motorcycle with a V-8 engine he built and driving it at 136 mph. He’d also made the first pre-announced public flight in the United States (earning pilot license number 1 from the

At the launch of the new reproduction, Curtiss enthusiasts re-create the 1914 christening of the original *America*. The woman in white plays the christener, who was unable to break a bottle against the hull. The crew trussed the bottle to the prow and applied a sledgehammer.

Aero Club of America), won the first international air race (earning pilot license number 2 from the Fédération Aéronautique Internationale; Louis Blériot held number 1), and made the first long-distance flight between two U.S. cities by flying from Albany to New York City. To overcome hydrostatic friction—a suction-like force that prevents seaplane hulls and floats from breaking free of the water—he invented the “step,” an angled break on the bottom of hulls and floats that enables the seaplane to rise from the water. The step is considered his most important contribution to the science of water flying. First perfected on the 1912 Model E (considered the world’s first successful flying boat), the invention earned him a prestigious Collier Trophy for the second time in two years (the first was for the invention of the “hydroaeroplane”). In the meantime, he was making his hometown arguably the aviation capital of the world. Says Art Wilder, a retired mechanical engineer and director of the museum’s restoration shop: “There was more done in Hammondsport between 1908 and 1914 than in any other period I’ve ever studied in aircraft history.”

Tourists may know the Finger Lakes region more for its wineries than for the achievements of its favorite son, but on an overcast day last September, the visitors were well aware of Glenn Curtiss’ work. They had come to see the museum’s reproduction of Curtiss’ 1914 flying boat, the *America*, make its maiden flight. The event has been on calendars far and wide. “We came all the way from Virginia for this,” said Joyce Miller, standing with her husband, Hugo, who wore a T-shirt reading “Wilbur and Orville who?”

It took three years to build the *America* reproduction. In 1999, the museum’s restoration shop volunteers completed and flew a reproduction of a 1913 Model E flying boat, and in 2004, they completed and flew a reproduction of the A-1 Triad. The Navy purchased the original A-1 in 1911—the service’s first aircraft. (This, combined with the fact that Curtiss trained the Navy’s first pilot, earned him the title Father of Naval Aviation.) But the museum considers the *America* in some ways a more significant aircraft. It incorporated counter-rotating propellers and an enclosed cabin, and it was the first flying boat with multiple engines—two, initially, then three. And, with a 72-foot wingspan and an empty weight of 3,000 pounds, it was mammoth. “Compared to other U.S. aircraft, the *America* was like Starship *Enterprise*,” Doherty says.

Curtiss museum engine specialist Norm Brush, left, and Lee Sackett, copilot of the reproduction, have front row seats as the *America* is towed to the christening.



With Glenn Curtiss at the controls, the *America* skimmed over Keuka Lake in 1914. “The finest flying craft I ever sat in – steady as a rock,” he reported, but he soon made numerous refinements.

The *America* was built to compete for a \$50,000 prize offered by the London *Daily Mail* for the first transatlantic crossing by a flying machine. Rodman Wanamaker, a son of the Philadelphia department store founder John Wanamaker, commissioned the construction, giving Curtiss \$25,000 to build what became the Model H Boat, the Curtiss-Wanamaker *America*. Wanamaker intended the flight to double as a centenary salute to 1814’s Treaty of Ghent, which ended the War of 1812, and he wanted a Brit and an American to share the honor. Cyril

Porte of the Royal Navy was named pilot, and George Hallett, a mechanic and Curtiss employee, was copilot. Both men were present on June 22, 1914, when the *America* was christened at Hammondsport before an audience of 2,000. One of Hallett’s challenging jobs was changing spark plugs in flight (plugs didn’t last long back then). One wonders how he felt about the prospect of doing so in rough air, bad weather, and evening darkness.

In the summer of 1914, the *America* underwent extensive testing. Barely a month before the flight was set to launch, World War I erupted. Porte

was recalled to England and the flight put on hold.

More than 50 years later, Hallett, in his memoirs, reflected on the scrubbed mission: “At that time none of us believed we could not have made the flight successfully, but looking back on it, after some years and much experience, it seems to me that we could not have made it.” Hallett concluded that the lack of a carburetor heating system, vibration capable of shaking loose engine cooling lines, or airframe icing would have doomed the flight. (The aircraft that finally made the first flight across the Atlantic was also a Curtiss-built seaplane, the NC-4, the only one of three NCs that made the 1919 attempt.)

The British military bought the *America* and a second Model H for its patrol aircraft development program, along with a score



NASM (SI NEG. #A-4813-A)

JAMES WYNBRANDT



NASM (SI NEG. #83-8674)

of H-4 *Small America* flying boats. Neither Model H survived. “They weren’t lost in accidents,” Doherty says. “They were tested to destruction. It was a harsh environment, and seaplanes tended to have short service lives.”

But the basic hull design survived, adapted for the United Kingdom’s larger coastal and anti-submarine patrol aircraft of World War I, starting with the Felixstowe F-1. Curtiss developed derivatives and sold them to both the U.S. and Imperial Russian navies. And the *America* lived on in the hulls of aircraft from Pan Am’s Boeing 314 Clippers to PBY Catalinas to Howard Hughes’ one-flight wonder, coincidentally also designated H-4. One has only to compare the broad, keeled bottoms of the *America*’s descendants with the jowly sponsons projecting from the *America* hull to see the family resemblance. “All the great flying boats of the world have bloodlines [reaching] back to this one aircraft,” says Jim Poel, a former airline captain, owner of a Republic RC-3 Seabee amphibian, and pilot of the reproduced *America*.

No complete set of blueprints for the original *America* exists. The museum based its reproduction on partial plans, photographs, and records of construction materials. The frame is ash and Sitka spruce; the wing ribs are pine. Like the original, the craft is painted dark red. Instead of the animal glues and silk Curtiss used to cover his Model H, the re-creation team used Polyfibre, a synthetic aircraft fabric, similar to Dacron.

Left to right: Norm Brush, Jack Wilbert, and Lou Fell sand to a high sheen before applying red paint. The reproduction made high-speed taxi runs but was unable to fly out of the water’s grip. The cabin, while spacious, carried few instruments.

When the twin-engine *America* proved underpowered, Curtiss added a third engine. It worked on Keuka Lake, but fuel consumption proved too high for an Atlantic crossing.

Once completed, the reproduction was disassembled into three major sections, which were trucked half a mile to the lake and put back together. At the start of last September’s Seaplane Homecoming Weekend, the flying boat sat atop a small gantry mounted on a pair of rails leading into the water. As the hour of launching neared, a crowd grew. The sky was overcast, making the day reminiscent of the black-and-white photographs documenting the original christening. Some onlookers gazed with the same curiosity seen in those old photos: *Will this thing really fly?*

Doubts were understandable. The original *America* was pow-



JEAN DOHERTY

ered by two 90-horsepower OX-5 V-8 engines. Because the reproduction was 500 pounds heavier, the team decided to use vintage OXX-6 100-hp engines, which were sent out in 2006 for an extensive rebuild; the revisions included a new water pump for the counter-clockwise engine, plus new camshafts, valves, and valve springs for both. But the engines weren't ready for the September flight, so the restorers substituted the OX-5s.

Up close, the craft looks less aero than nautical. The sponsons give it the appearance of a hydroplane, a boat with wing-like structures that enable it to skim the surface of the water at high speed. The cabin looks more like a pilot house than a cockpit, and the primary navigation instrument is a large ship's compass. While remaining largely faithful to the original, the reproduction has a digital engine monitor, and trim tabs have been added to the jumbo-size elevator and vertical stabilizer to reduce the forces needed to control it. "Basically it's very heavy," says Poel, who flew the museum's previous reproductions. "It will take a lot of force to move the controls."

In the early afternoon, seaplanes paraded around the south end of the lake before performing a flyover, circling Curtiss' grave at the Pleasant Valley Cemetery. Then, the *America* was eased into the water and towed to Depot Park, just down the shore, for christening. A crowd estimated at 3,000 awaited its arrival, and a half-dozen Grumman, Republic, and Cessna amphibians were arrayed around the adjacent beach in welcome. Museum volunteers in period costumes portrayed a welcoming committee to reenact the christening. Jim Poel, copilot Lee Sackett, and Orren Baisch (as Glenn Curtiss) stood in for the original christening party, with Poel's wife, Lovada, representing Katherine Masson, the daughter of a local vintner, who in 1914 was selected to christen the big flying boat. Then the reborn *America* was pushed off the beach and turned lakeward, the OX-5s were propped by hand and fired up, and the aircraft taxied out.

Word had been circulating since morning that the *America*

was not quite ready to fly. Though the hull rode in the water at the same level seen in photos of the original, during water taxi tests conducted in the last few days it was not getting up on the step. "We sort of make the same mistakes Curtiss did, even though we know a lot more about aerodynamics," Poel says philosophically. "We still stumble along, and then we realize: That's what he was doing too."

"One of our friend's dads used to work with Curtiss, and he said a lot of things they tried didn't work the first time either," Wilder says.

In the end, it didn't seem to matter to anyone that the *America* didn't fly that afternoon.

The crowd watched this visitor from another era turn grand circles in the water, leaving big, frothy plumes behind. "That's the way it goes," said Jim Flieg, an industrial engineer from Potter, New York, who came to see the *America* with his father, John, and son Joshua. "I work on machinery. And when someone's been working on something and they flip the switch and it actually does something, I'm thrilled."

"We've re-created a moment in history here," Poel said after bringing the *America* back to the shore. "And to see it taxi

around and to hear two OX-5 engines is something not many people get to experience."

The *America* is back on display at the museum while efforts to overcome its hydrostatic friction continue, mainly by finding ways to reduce weight. Another area under study is finding a stabilizer incidence angle relative to that of the wing that produces optimum lift. The team is also tweaking trim and rigging. And soon the more powerful OXX-6 engines will be installed. "We'll work on engines and propeller combinations and do some serious thrust measurements that we haven't done before," Wilder says. The *America*'s first flight, anticipated to be made this spring, will likely be a quiet occasion, Doherty says, with the public debut planned for the next Seaplane Homecoming in September. ➔

On a summer's day in 1914, a happy crowd turned out for the *America*'s launching at Keuka Lake. A Curtiss Hydroaeroplane is docked behind the *America*.



NASM (SI NEG. #94-18)



JAMES WYNBRANDT (2)





BEST OF THE BATTLE *of* BRITAIN

WAS IT THE HAWKER HURRICANE
OR THE SUPERMARINE SPITFIRE?



Here, the Spitfire leads; World War II statistics say otherwise.

BY JOHN FLEISCHMAN PHOTOGRAPHS BY JOHN DIBBS

THIS SPITFIRE HAD IT ALL.

It was a Mark Vc, the distillation of everything the Royal Air Force had learned in the desperate days of the Battle of Britain.

“This is the gold standard,” Martin Henocq tells me. “This is the one everyone wants.”

Henocq is the shop foreman at Historic Flying Limited in Duxford, England, a private restoration outfit that specializes in raising highly desirable Supermarine Spitfires from the dead. As Henocq sketched out the beauties of this example, I suddenly wanted to sit in the cockpit—badly.

The object of my lust was a Spitfire with the airframe number JG891. It had returned to England in 1999, 56 years after it was shipped to the Royal Air Force's fleet in North Africa. En route, the crated Spitfire was diverted to an assignment with the Royal Australian Air Force. In 1944, JG891 attempted a landing on a wet jungle airstrip in the Solomon Islands, ran off the far end, and flipped.

Thirty years later, a New Zealand flying enthusiast hauled the wrecked fighter to his home for a back yard restoration. He never quite finished. Twenty-five years after that, Historic Flying imported the fuselage, most of the wings, and a wild miscellany of leftover parts. The restoration shop had the resources, skills, and special wing jigs required to make JG891 whole again.

It's the wings that separate the amateurs from the professionals, says Henocq. “Everyone does the fuselage. They like having it there in the shop so they can sit in the cockpit and think they're nearly there, nearly done with the project, and nearly ready to fly. They'll say it's almost done but it's never done.”

Historic Flying got its start in the late 1980s, when the Royal Air Force was persuaded to replace many of its deteriorating “gate guardians”—surplus Spitfires stuck on poles at air bases—with fiberglass replicas. The gate guardians were trucked away for reconstruction as museum pieces or flying restorations.

The golden era of the gate guardians is over, though. “We're running out of good airplanes to do,” says Henocq. These days, available Spitfires are often abandoned private restorations, ex-gate guardians from air forces in faraway lands, and crashed aircraft back for a second or third rebuild. “Finding customers doesn't seem to be the problem,” says Henocq. “It's the supply.”

JG891 stayed in storage for five years before Historic Flying spent 18 months transforming it from a nightmare to a flying machine, salvaging some parts and replacing others. Retro Track & Air in the United Kingdom supplied an overhauled Rolls-Royce Merlin 35 engine. Other vintage parts used include a gun-sight, IFF (identification friend or foe) transmitter, and Dowty propeller.

In the summer of 2006, JG891 was get-





ting its last “bits and bobs” at Historic Flying, along with a new radio and a GPS navigation system. Henocq and I were standing alongside the fuselage so he could show me the fine points of the cockpit when I finally lost control. The side hatch was folded down. The bubble-shaped Plexiglas canopy was pushed all the way back. What did I have to lose? “Could I...? I wonder if...? Maybe, um...?”

It was no problem. From a roll-up step platform, Henocq coached me on how to climb into a Spitfire. “You put your left foot there on the edge,” he said. “Then with your right foot, stand on the seat. Now hold here.” He guided my hands to a grip as I swung my other foot on board and lowered myself into the seat. “Do you see those shiny stripes down there?” he called out. “You want to put your feet up above them on the pedals.” And there I was, sitting ear-deep in a Spitfire cockpit.

Henocq called out to his shop guys: “All clear on control surfaces? All clear on electrics?” Then he showed me how to swing the rudder, pull back on the stick, and break right and left. “If you reach down there on your right, you can throw the power switch,” he said. Red lights blossomed around the cockpit. “And here’s your gun button.” Henocq adjusted the anti-glare gunsight screen and flipped a switch to project crosshairs onto the windscreen. And here the illusion stopped: The crosshairs didn’t light up.

Henocq studied the gunsight. Apparently a new bulb was still to be installed. It was just as well or I might have swooned.

Instead, I squinted down the Spitfire’s long Merlin-filled nose, through the three-blade prop, to scan the clouds swirling over Duxford. Tally-ho! Bandits at six o’clock! My left hand went for the gun

A Merlin fires up during a powerplant test for a restored Spitfire.



At Historic Flying Limited, the Spitfire reigns. Shop manager Martin Henocq (above, right) and technician Martin Overall use original parts, including a pilot’s seat (above) and a wing leading edge (right), as templates for creating new ones (in green).

button, but I swear I didn’t say “*Rat-a-tat-tat*.” (At least not out loud.)

Warbird intoxication is a widespread ailment, even if most of the afflicted get no closer than photographs or static aircraft displays and flybys at airshows. For those who can afford a serious case, there are few more dangerous afflictions than Spitfire fever. It burns brightly in hearts across the old Commonwealth, including India, Pakistan, Australia, New Zealand, and Canada, but also in places like the Netherlands and Israel, where after the war Spitfires served as air force founding fighters. Americans are susceptible too: U.S. Army Air Forces squadrons flew Spitfires out of England and in the Mediterranean theater until well into 1944. Not surprisingly, though, Spitfire fever is strongest in the United Kingdom.

For Britons of a certain age, the very name recalls a historic pageant: Dapper young pilots scramble from lawn chairs, London burns, and Luftwaffe aircraft break apart in gun camera films, all against a soundtrack of sirens, whistling bombs, and Winston Churchill growling his way through the Few, the Many, the Finest Hour, etc. Slicing down the middle is the Spitfire, the airplane that won the Battle of Britain.

Well, not exactly. Such a statement

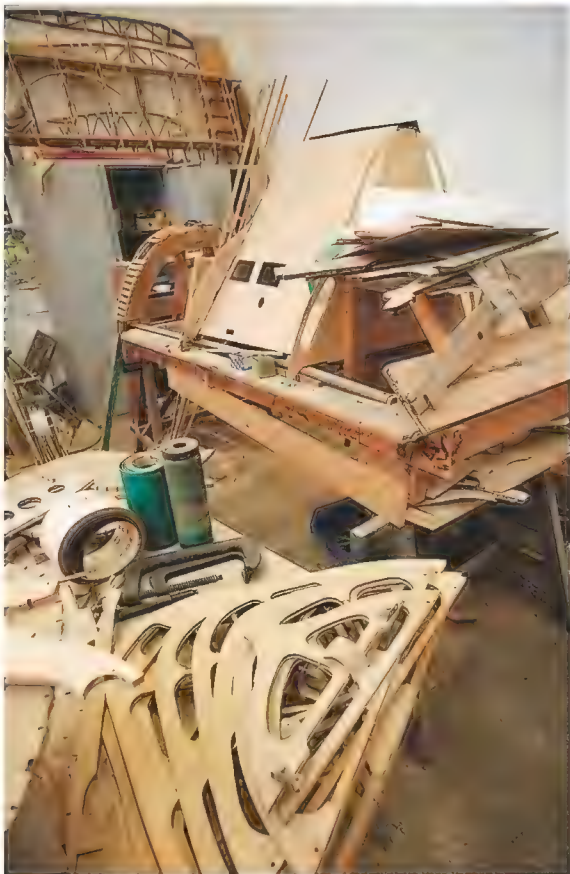


leaves out the Hawker Hurricane, the other frontline fighter the Royal Air Force fielded in the battle. In July 1940, when the fight began, the RAF Fighter Command had 396 operational Hurricanes and 228 Spitfires. That ratio, three Hurricanes to two Spitfires, held through the summer. Fighter Command tended to steer Spitfires against the Luftwaffe’s high-altitude fighters, freeing the Hurricanes to attack the slower, lower-flying German bombers. By the battle’s nominal close, at the end of October, Hurricanes had claimed 656 enemy aircraft, versus 529 for Spitfires.

Yet Spitfires got top billing. In the “after myth” of war, Hurricane supporters have long complained that their fighter was denied full credit. They even name the villain, British actor Leslie Howard, and the 1942 film he directed and starred



Tony Ditheridge is the founder of Hawker Restorations, which has mastered the art of rebuilding the Hurricane's complex airframe. Guided by designer Sydney Camm's specifications, craftsmen replicate the Hurricane's wood members (left). The restoration hangar is separated from Ditheridge's 15th century farmhouse by a moat (below).



in, *The First of the Few*. A half-century after its first run, John W. Fozard, a retired Hawker designer and aviation historian, wrote a book titled *Sydney Camm and the Hurricane*, in which he denounced *First of the Few* as the “infamous wartime movie...that fixed forever in the public mind the image of the Spitfire as the winner of the Battle of Britain thus performing a permanent assassination job on the Hurricane.”

You can still catch *The First of the Few*, which has been released on video. It's a creaky, old-fashioned biopic about the Spitfire's designer, R.J. Mitchell, who died of cancer at age 42. (In the film, though, Mitchell succumbs to what the physician character refers to as “overdoing it, old boy.”) Mitchell lived to see his prototype fly, but not the operational Spitfire squadrons that were filmed for the movie's opening

montage. There is not a single Hurricane in sight.

Even today, the Battle of Britain is thickly barnacled with myths and celluloid memories, and historians approach the subject warily. Richard Overy, a professor of modern history at King's College, London, is one of the brave. Overy has chipped away at some of the crustiest legends: that the British public was 100 percent behind its bulldog prime minister (the government's top-secret surveys showed that the average Londoner's enthusiasm for Churchill was inversely proportional to how heavily he or she was being blitzed every night) and that Adolf Hitler was champing at the bit to invade England in 1940 (Hitler was an opportunist, says Overy, but was more interested in forcing the British into a one-sided “peace” treaty so he could devote all of his resources to conquering Russia).

On one point, Overy remains a True Blue about the battle. “Britain was forced to fight with what she could produce herself in 1940,” he writes in his 2004 book *The Battle of Britain*. “The aircraft available were among the very best fighter aircraft in the world. There is no myth surrounding the performance of the Hawker Hurricane and Vickers Supermarine Spitfire, which between them formed the backbone of Fighter Command.”

No matter what they flew, British pilots faced grim odds. Of the 2,917 men who flew for Fighter Command that summer, 544—almost 20 percent—were dead by the end of October.

Unlike idolized Spitfire designer Mitchell, Hurricane designer Sydney Camm did not inspire the making of any wartime biopic. For one thing, Camm was alive and continuing to be his difficult self. “An odd combination of arrogance and diffidence—each characteristic feeding the other” is how one Air Ministry civil servant described him. Yet despite Camm's daily tongue-lashings, the young men who crowded the design office at Hawker worshipped him, according to Fozard, who was one of Camm's apprentices. “Most of us would have walked on glowing coals if he had asked us so to do in the interests of the job,” wrote Fozard in his book. Camm, or Sir Sydney, as he became after the war, lived a long, honored life, continuing as chief designer for Hawker-Siddeley until his death in 1966. Camm led Hawker into the Jet Age with the Hawker Hunter fighter and pushed the company into short-takeoff-and-landing technology with the P.1127 project, which evolved into the Harrier jump jet.

Yet Camm is remembered today for the Hurricane, which in turn is remembered as the Battle of Britain fighter that was not the Spitfire.

In truth, the fighters had much in common, starting with the engine they shared, the experimental Rolls-Royce PV-12 that became famous as the Merlin. Both fighters were the product of the frantic rearmament race set off by Hitler's chilling





1934 debut of the Luftwaffe, with its bristling array of swift, low-drag monoplane designs. In 1934, the Royal Air Force's frontline fighter was the Hawker Fury biplane, with a top speed of 200 mph. It had two machine guns, an open cockpit, no oxygen system, and an ineffective radio. The Air Ministry needed a more advanced fighter—quickly. The leading designers were Mitchell at Vickers Supermarine and Camm at Hawker.

Camm came up through the ranks of the Hawker drafting office in the 1920s,

working on a series of Royal Air Force biplane designs. Camm's design for the Fury, which he developed in 1931, marked him as a master of Hawker's tradition of building airframes from struts and wire. When the big hurry-up began in 1934, Camm decided against a radical retooling for the new monoplane interceptor. He figured he would have his hands full dealing with the long, liquid-cooled Rolls-Royce engine and his first retractable landing gear.

Before it was bought by Vickers in 1928, Supermarine had been a small niche de-

Because Britain was short on aircraft carriers, the Royal Navy flew Sea Hurricanes (above), which were rocket-propelled from cargo ships to intercept German aircraft.

signer, filling contracts for flying boats. Mitchell also followed the draftsman's route into the aircraft business, rising quickly as an apprentice designer on Supermarine's amphibian projects. In 1925, Mitchell designed the startling Supermarine S.4, a single-seat seaplane racer. To the modern eye, the S.4 looks like a Spitfire on floats. It's not, but if airplanes can be said to have genes, the S.4 is the Spitfire's grandfather. A mid-wing monoplane, the S.4 is driven by a long, narrow, liquid-cooled engine and sits on fully cantilevered floats. There are no bracing wires.

Designing for Supermarine, Mitchell learned how to build in metal. Supermarine's bread-and-butter product in the early 1920s was the two-engine Southampton flying boat. The original, with a hull of double-skin, diagonal mahogany planking, was a fine specimen of traditional boatbuilding but monstrously heavy. Mitchell duplicated the hull but used a light metal alloy that maintained strength,





cut weight, and improved performance. Under the skin, his S.4 racer had a conventional strut-and-wire construction, but each succeeding S racer design incorporated more sheet metal. By the time the Air Ministry sounded the alarm in 1934, Mitchell was already working on an all-metal airplane in which the metal skin would serve as the frame: a monocoque design.

By 1934, both teams had started to think about their monoplane designs when Camm and Mitchell received visits from Squadron Leader Ralph Sorley of the Royal Air Force's Operational Requirements Branch. He told them that the Air Ministry had been running tests on a firing range and had determined that it would require 266 hits from .303-caliber ammunition to lethally damage an all-metal bomber. The Air Ministry had further calculated that at a closing speed of 180 mph, a fighter would have two seconds to score. Thus, at 1,000 rounds per minute per machine gun, the new interceptor would need eight .303 Brownings to deliver a total of 266 rounds in a two-second burst. Could the designers squeeze eight guns into their interceptors?

The gun requirement was less of a problem for Camm's prototype Hurricane, which had wings thick enough to house four weapons apiece. But for Mitchell's thinner-wing Spitfire, the eight-gun requirement created a major problem. Beverly Shenstone, a Canadian aerodynamicist, had already convinced Mitchell that the Spitfire should have an elliptical wing, like the one on Germany's high-speed Heinkel He 70 airliner. Then considered the epitome of streamlined design, the He 70 had caused a sensation in British aeronautical circles. Such a planform would permit a speed-friendly, thin thickness-to-chord ratio (the ratio of wing depth to the distance from the leading to trailing edge) while still providing space sufficient to house the guns and retractable landing gear. But now, even this ellipse

Historic Flying restored a Mark Vc version of the Spitfire, modeling the aircraft on the Spitfires assigned to the Royal Air Force's fleet in North Africa. Wearing desert camouflage, the aircraft has been fitted with the engine intake used to keep sand out of the Merlin powerplant.



had to be broadened and skewed slightly forward to ensure that it could retain its thin section yet accommodate the additional weapons. Gone was a Heinkel-like symmetrical ellipse; in its place was the Spitfire's trademark pointy-tip shape.

The Hurricane flew for the first time on November 6, 1935. The first Spitfire flew four months later, on March 5, 1936. In June—not a moment too soon—the Air Ministry ordered 600 Hurricanes and 310 Spitfires. The first production Hurricanes began reaching squadrons in January 1938. The Royal Air Force didn't get its first service Spitfires until August 1938. The Second World War would begin 13 months later.

Time had already run out for Mitchell,

The Spitfire (left) and Hurricane cockpits, though snug, both offer excellent visibility. The flight control sticks for the fighters are topped with round grips known as spades.

who died in June 1937. Mitchell's successor, Joseph Smith, had the daunting job of transforming a prototype into an operational military aircraft. No one in Britain had ever mass-produced a fighter as advanced as the Spitfire. It took Smith and Vickers Supermarine a while to figure the process out, which is part of the reason that in the Battle of Britain, more Hurricanes flew than Spitfires. In 1940 there were just enough of each to hold off the Luftwaffe. To understand how close Britain (and the rest of the free world) came to defeat that summer, I had to see a Hurricane naked.

I went looking for one in the idyllic village of Milden, deep in the Suffolk countryside of eastern England. Milden is the home of Hawker Restorations Limited, which is the domain of Tony Ditheridge. Hidden behind a towering hedge on a narrow lane, Hawker Restorations comprises a compound of garages, workshops, and fields surrounding Ditheridge's 15th century moated farmhouse. "It's a listed building," Ditheridge says, meaning that before he can so much as dredge the moat, a historic preservationist has to come out for an inspection.

I had come in secret hopes of cadging

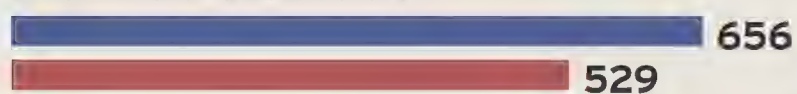
Just How Few Defended the Many?

Battle of Britain, July 10 to October 31, 1940

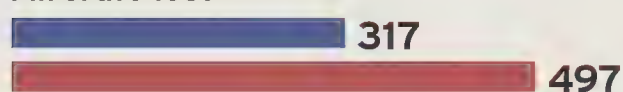
Aircraft available on a weekly average basis



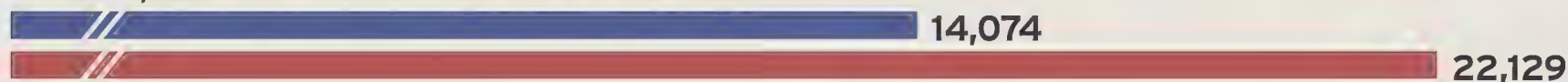
Kills of Luftwaffe aircraft



Aircraft lost



Aircraft produced across all models and variants



Notes: Aircraft available to the RAF Fighter Command are an average of weekly reports and the best available records kept during the Battle of Britain. Total number of Spitfires produced includes those converted to Seafires.

Sources: Peter Elliott, Senior Keeper, Department of Research & Information Services, Royal Air Force Museum, Hendon, London, England; State of Aircraft in Operational Commands, Air Ministry, London, England; John Alcorn, Battle of Britain Top Guns, *Aeroplane Monthly*, July 2000



Hurricane designer
Sydney Camm



Spitfire designer
R.J. Mitchell



The English coast beneath a Spitfire wing, a sight that would have been familiar to the island nation's defenders.

Historic Flying's John Loweth (left) is a painting specialist.

motor crane that he'd rented to lift it over his front hedge and onto a flatbed lorry.

A seat in a Hurricane is rarer today than one in any old Spitfire: Over time, 22,129 Spit-

fires were built, versus 14,074 Hurricanes. Hawker Restorations welcomes every opportunity to preserve the scarce fighters. With the Seattle-bound Hurricane out the door, Ditheridge's shop crew had already filled the empty bay with a new restoration project.

As Ditheridge and I walked down to the shop, he told me how he made his fortune in the 1980s selling medical imaging systems around the world. In the 1990s he moved into aircraft reconstruction, combining his passion for flying with his knack for managing technologies, only this time it was the technologies of 1940s metal warplanes like Spitfires, Corsairs, and Mustangs. Along the way, Ditheridge was drawn into pre-World War I projects, restoring and replicating flying machines made of wood, wire, and canvas. From there, a jump to Hurricane technology was not too far.

To give me an idea of what some of his rougher projects look like when they arrive, we stop outside the shop so Ditheridge can show me his aluminum scrap heap.

"Just imagine 2,000 pounds of this," he says, pointing to a three-foot-high mound of shredded, corroded sheet metal. Inside the shop, three bare-bones Hurricanes are waiting. One look around is more enlightening than a thousand pages of Battle of Britain history. Though the modern eye might perceive them as a manufacturing nightmare, the Hurricane's mechanical joints would have seemed very familiar to aircraft builders in 1940, says Ditheridge. It was the Spitfire that gave them conniptions. The Air Ministry calculated that building a Spitfire took 15,200 man-hours but a Hurricane took only 10,300. Camm's old technology saved the day, at least in 1940.

In combat, Hurricanes were also stur-

a seat in a Hurricane cockpit, but Ditheridge broke it to me immediately: I was a week too late. He'd just dispatched an ocean-going shipping container housing the fuselage of a late-model Hurricane XIIB and a 40-foot cargo rack holding the airplane's wings. They were bound for the port of Seattle and Microsoft billionaire Paul G. Allen's Flying Heritage Collection in Arlington, Washington (see "Crown Jewels," Oct./Nov. 2004). Ditheridge had photographs of the Hurricane and of the

fires were built, versus 14,074 Hurricanes. Hawker Restorations welcomes every opportunity to preserve the scarce fighters. With the Seattle-bound Hurricane out the door, Ditheridge's shop crew had already filled the empty bay with a new restoration project.

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FOR MORE ON THE HAWKER HURRICANE on exhibit at the National Air and Space Museum, visit www.airspacemag.com.

dier than Spitfires. A bullet or even a cannon shell could pass harmlessly through a Hurricane's canvas skin. If ordnance struck a structural member, the average Royal Air Force ground crew had the tools and expertise to fix the damage on the spot. For more serious wounds, the Air Ministry set up a civilian repair organization to sort through damaged Hurricanes, repairing what could be fixed and junking what couldn't. In 1940 alone, the triage operation returned 973 Hurricanes to combat squadrons.

Today, according to Ditheridge, the equation is reversed. With its elaborate tube frame and wooden members, a Hurricane is much more work than a Spitfire. "We could restore two Spitfires to one Hurricane," says Ditheridge. Camm also designed the Hurricane for production by machinists who knew the patented Hawker techniques and pattern-makers who could turn his complex drawings into easy-to-use templates. "He didn't make it easy to re-create it without a vast factory and an experienced workforce," sighs Ditheridge. "There are times when I'd like to get him in a dark room alone."

To rebuild a Hurricane requires an assortment of crafts: steel tubing bending, high-style cabinetry, sheet metal origami, sewing, and archaic pneumatic plumbing. The wheel brakes were actuated by a shot of compressed air, inside the hub, inflating a rubber bellows, which "are getting as scarce as hen's teeth," says Ditheridge. "I don't even want to think about looking for those right now."

Yet the biggest problem facing Ditheridge and the community of would-be Hurricane owners is not lost skills or hard-to-find parts. It's finding whole airplanes. Ditheridge does his best by watching for stalled private projects and tracking down rumors.

The Canadian north woods is said to be littered with Canadian-built, Royal Canadian Air Force-crashed Hurricanes. Supposedly, Hurricane gate guardians abound in Myanmar (formerly Burma),

and ditched fighters are said to lie at the bottom of Arctic lakes. Russian deals tend to be a bit "dodgy" these days, says Ditheridge, but there are certainly many picked-over Hurricanes in that country. "You gave the Russians 3,000 P-39s," he explains. "We gave them 3,000 Hurricanes." Ditheridge rejects no source as too outlandish. He tells me that one of his current projects will be powered by a Merlin engine discovered driving a rock-crushing machine in Colorado.

Walking around the Hawker Restorations shop, I can easily discern the structural differences between the Hurricane and the Spitfire. The aluminum skin of the Spitfire serves as an exoskeleton, like an insect's shell. A Hurricane, on the other hand, has an internal skeleton, like a

bird's. A Hurricane's skeleton is a tapering box of steel tubes, braced by wires and joined with sockets, flanges, and pins. Over that go the wooden ribs, spars, longerons, and plywood sheets that are this bird's flesh. Over that go the feathers: Irish linen doped with nitrocellulose. The sight of so much woodwork on a World War II fighter is startling. In the early stages of construction, the fuselage looks like a boat hull. As it fills up, the fuselage resembles a flying grand piano, with all the wires, tubes, and castings fitted inside a masterpiece of cabinetry.

"When it's finished but not yet fabric'ed, people say that the Hurricane is the most beautiful aircraft they've ever seen," says Ditheridge.

I can't say I disagree. —



Stripped of its canvas skin, the Hurricane's wood fuselage is a masterpiece of sculpture. Will Lee helped restore the National Air and Space Museum's Hurricane, which is now on display at the Steven F. Udvar-Hazy Center.

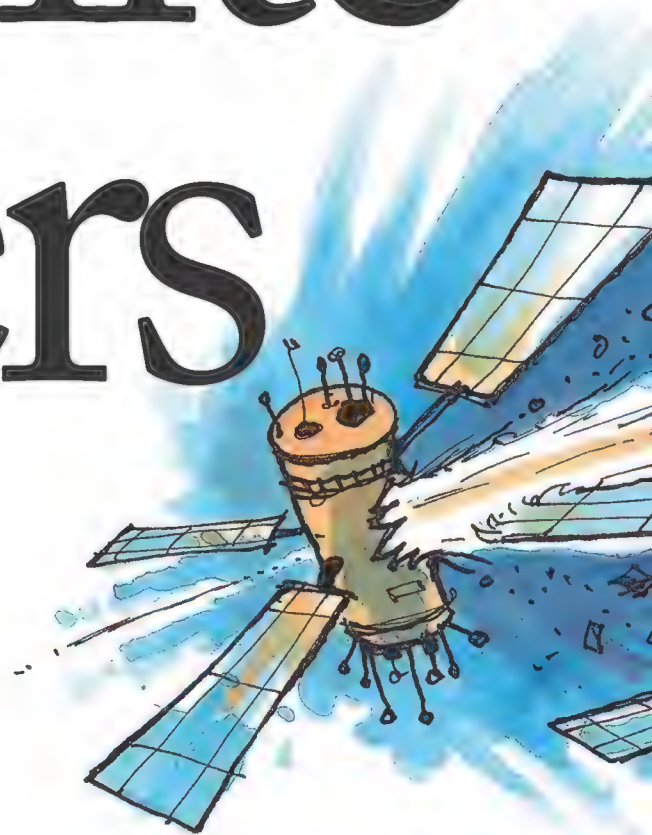
CHAD SLATTERY

Satellite Smashers

**SPACE JUNK WILL SOON
START TAKING OUT
EXPENSIVE SPACECRAFT.
WHAT'S THE CLEANUP PLAN?**

BY TONY REICHARDT

ILLUSTRATIONS BY DAVID CLARK



IT'S HAPPENED ONLY THREE TIMES, as far as we know: three occasions when two sizeable objects in Earth orbit have accidentally collided at high speed. The first, or the first to be clearly identified, was in July 1996, when a fragment from a long-disintegrated Ariane rocket stage hit a French military satellite called Cerise at nine miles a second. The impact cut in half a 20-foot boom extending from the spacecraft, thereby adding another bit of junk to the 12,000 pieces currently being tracked in space. Cerise kept operating, which was lucky. Lab tests conducted last year in Japan, of impactors striking smaller satellites at much slower speeds, smashed the targets into smithereens.

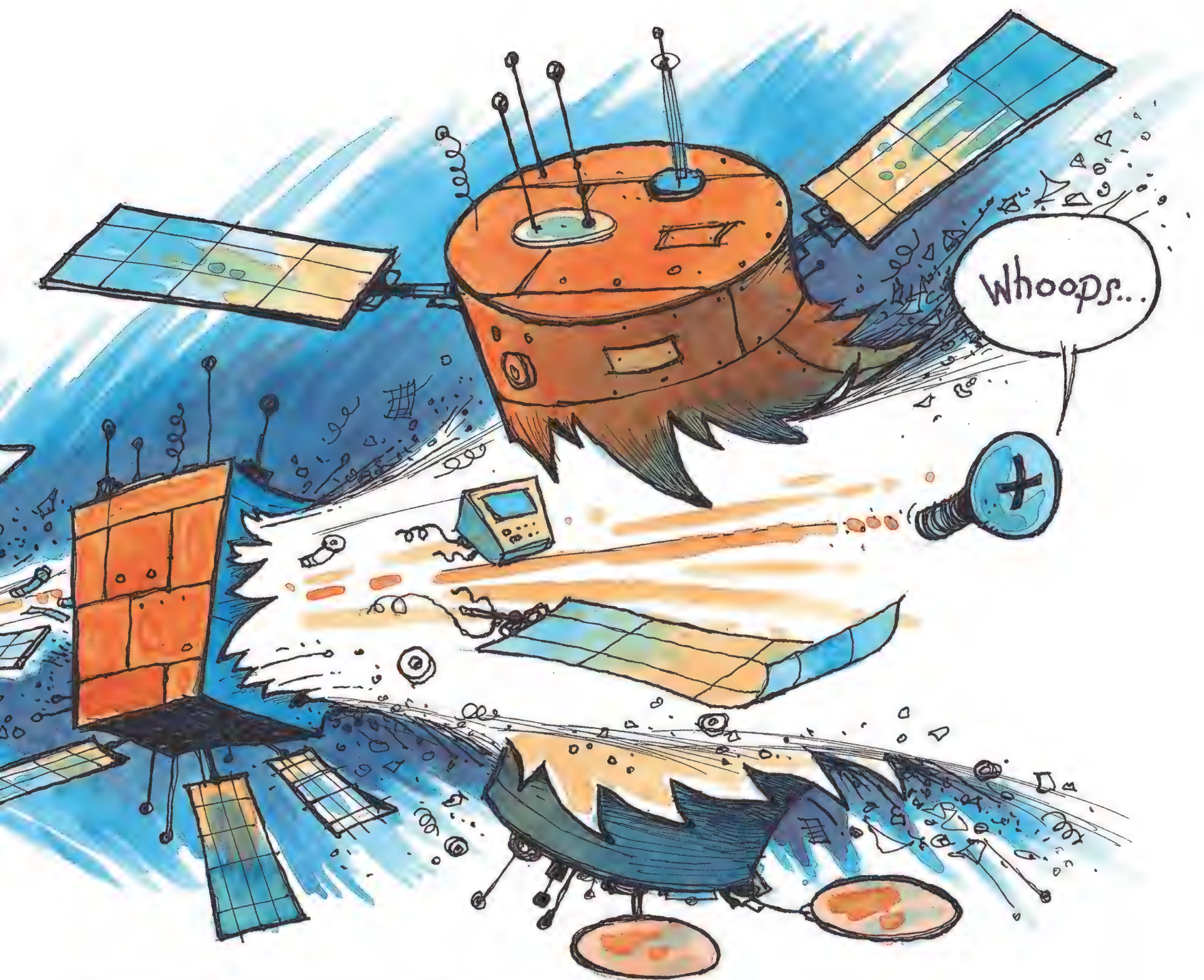
Another collision happened five years earlier, although it wasn't understood until recently. A defunct Russian navigation satellite (Cosmos 1934) ran into a fragment from another Cosmos while both were circling in similar 600-mile-high orbits. Tracking networks soon noticed two new pieces of debris produced by the collision.

The third occurred in January 2005, when a fragment from a Chinese rocket struck a U.S. rocket stage that had been orbiting for 31 years, breaking off three pieces of debris from the larger object. Lucky again.

Most experts on space debris say that in terms of both the frequency of these events and their severity, our luck will soon run out. Collisions among pieces of debris in space beget more debris, and certain orbits—particularly the polar orbits favored for weather satellites and other Earth observers—will eventually become hazard zones. It's not an emergency yet, says Nicholas Johnson, the chief scientist at NASA's orbital debris program office at the Johnson Space Center in Houston. But it's time to act.

In an influential article published in *Science* magazine in January 2006, Johnson and his NASA colleague Jer-Chyi Liou argued that only "the removal of existing large objects from orbit" can keep the problem from getting worse.

The scientists used computers to simulate the proliferation of debris in Earth orbit over the next 200 years, assuming no more satellite launches—a hypothetical best case. Their models predict that, up until 2055, the creation of new debris from collisions will be balanced by the disappearance of old junk, which burns up in the atmosphere as its orbit decays. After 50 years, though, as more collisions occur, the creation of debris will start to predominate. The simulations predict 18 collisions over the course of 200 years, each yielding hundreds or thousands



of fragments that exacerbate the risk. Even if we never launched another satellite—and of course we will—Johnson and Liou wrote, “The current debris population in [low Earth orbit] has reached the point where collisions will become the most dominant debris-generating mechanism.”

Although the scientists conclude that it’s time to start cleaning up, they also acknowledge that “no single [cleanup] technique appears to be both technically feasible and economically viable.”

Two years later, that’s still the case: No one knows how to begin removing orbital debris. “No easy or cheap solutions have yet been identified,” Johnson says flatly. It isn’t for lack of ideas. Well-meaning inventors have come forward with all kinds of schemes for clearing out space junk: space flypapers, sweepers, robot garbage scows. Take, for example, U.S. patent no. 4,991,799, filed in 1990, for a propeller-like sweeper that would ram into small particles and knock them from a threatening orbit. Or patent no. 6,655,637, filed in 2002, for a robot that could grab space junk with “inflatable fingers.”

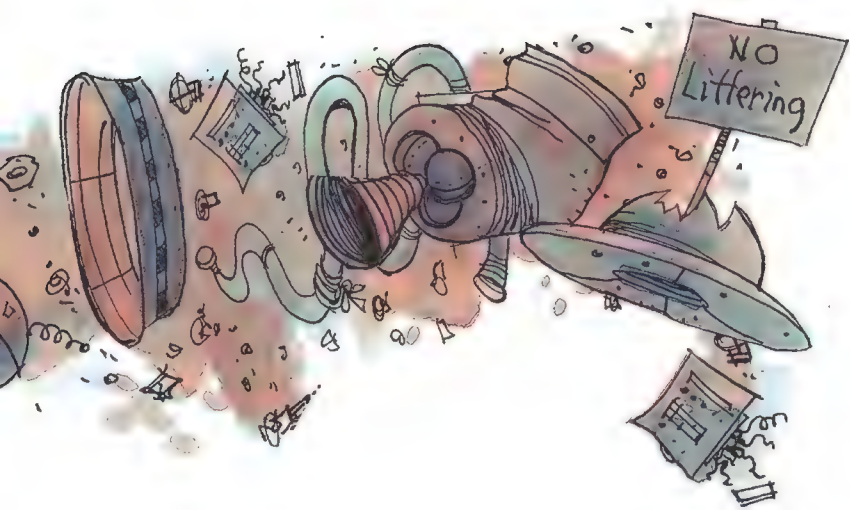
“Some of the ideas are technically outlandish,

some are technically feasible,” says Johnson. The problem, almost always, is cost. “If you want to spend tens of millions to retrieve a single rocket body, you can do it,” he says. “But it doesn’t make any sense economically.”

So Johnson and other debris experts from Europe, the United States, and Japan are working on a comprehensive study for the International Academy of Astronautics that will evaluate cleanup options. Results are due next year.

The ideas tend to come in two sizes: systems for clearing out particles smaller than 10 centimeters (four inches), and schemes for “de-orbiting” large objects like whole rocket bodies, usually by pushing them down to lower orbits, where they burn up due to increased atmospheric drag.

Fragments between 1 and 10 centimeters in size will penetrate most spacecraft, according to the Aerospace Corporation’s Center for Orbital and Reentry Debris Studies, and more than 100,000 are estimated to be circling Earth. (Pieces even smaller than



Application Survivable Tether, built by Tethers Unlimited, Inc. of Bothell, Washington, got hung up while one tether-deploying satellite was separating from a companion satellite. In September, a tether called YES2, built by European students, apparently extended to its full length of 18 miles in orbit, a new world record. But only apparently. The YES2 team had to piece together what happened, because the satellite attached to the end of the tether disappeared and hasn't been heard from since.

Rob Hoyt, president and chief scientist at Tethers Unlimited, admits that the glitches and half-successes haven't exactly inspired confidence. Yet he is not alone in believing that tethers will, after more flight experiments, eventually be certified for real work, including debris removal. The Japanese space agency JAXA is working on designs for a small satellite that could attach a tether to a piece of space junk to remove it from orbit. A tether test is planned in space, says project engineer Satomi Kawamoto, although no date has been set.

Johnson agrees that tethers should be able to handle the de-orbiting job, and says their first use may be as kits attached to new satellites as a means to dispose of them safely at mission's end. Hoyt's company has just such a system in mind—the Terminator Tether—which he hopes could be priced at under half a million dollars.

Installing a tether on the ground before launch is one thing. Attaching a tether, or any kind of de-orbit package, to a crumbling, tumbling rocket stage in orbit is another—particularly if the target has nothing for the package to hold on to, because it wasn't designed to be touched ever again by human or robot after being put in space.

JAXA engineers are looking at several options for wrangling such uncooperative targets. In one scheme, the junk removal satellite would dampen any tumbling motion of a large object by shooting small projectiles at it—ice pellets work nicely—before moving in to attach a tether.

In 2003, Tethers Unlimited designed a system called GRASP (Grapple, Retrieve, And Secure Payload), which used a net made of Kevlar yarn to snare a small object and steady it enough for a tether to be attached. With funding from the Defense Advanced Research Projects Agency, the company got as far as

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Over the long term, removing large objects like empty rocket stages is the most effective way to reduce the likelihood of collisions, since large objects account for most of the total surface area that could be hit by smaller pieces.

testing a prototype during short stretches of weightlessness on a zero-G airplane flying parabolic arcs. It worked, says Hoyt, but DARPA hasn't come through with money for a follow-on test.

And that, as usual, is the rub. No public or private entity has volunteered to research, let alone build, an operational junk removal system.

One would expect satellite owners and insurers to take an interest, but relatively few satellites in polar orbits are privately owned, and assigning blame for orbiting debris collisions is still a fuzzy area of the law. Who was at fault, asks Johnson, when an old rocket fragment and the Cerise satellite ran into each other in 1996? Neither object had the ability to maneuver, and the fragment had been orbiting for years before Cerise was launched. "There are no rules of the road in space," he says. And because collisions have been extremely rare, insurance premiums haven't risen enough to press satellite owners into doing something about the debris problem.

And so the junk multiplies. The last year alone has seen the two worst space-junk-producing events in history. Last February, leftover propellants in a two-ton Russian Briz-M rocket stage caused it to explode, producing about 1,000 new pieces of orbital debris. Fragments from rocket stage explosions make up the majority of space junk, and most satellite-launching nations have now learned to vent leftover propellant from used rockets so they don't turn into orbiting bombs like the Briz.

But the worst case of orbital littering ever was deliberate. On January 11, 2007, as part of an anti-satellite test, China slammed some kind of impactor into its own Fengyun 1C weather satellite. By year's end, 2,500 pieces of debris were being tracked. Last summer one of those speeding fragments forced NASA to hastily move its \$1.3 billion Terra Earth-viewing spacecraft out of the way. These kinds of evasive maneuvers are no longer uncommon for large spacecraft, including the International Space Station.

Expect to see satellites undertake more and more debris-dodging maneuvers. And hope that somebody finds a way to lower the cost of building and deploying space junk collectors—in case those satellites can't dodge quickly enough. ➤

DAVID JOHNSTON



M • Ed Maloney's Mission

SIMPLE. SAVE THE AIRPLANES.



ONE OF THE MOST OBSCURE aircraft of World War II, the Mitsubishi J8M1 Shusui, survives today only through remarkable happenstance. The Shusui is a Japanese copy of the Messerschmitt Me 163 Komet, a rocket-powered interceptor produced late in the war to defend German cities from Allied bombers. In 1943, Japanese military attachés, knowing that U.S. B-29s would soon be unleashed against the home islands, bought the Komet design from the Germans. By August 1945, however, only a few pre-production models had been built.

There are two places in the world today where the rare Shusui aircraft can be seen. One is the Mitsubishi factory museum in Komaki, Japan, where a damaged Shusui discovered in a Japanese cave in the 1960s has been restored for display. The other, thanks to the foresight of a teenager who spotted the craft in a southern California storage yard, is the Planes of Fame Air Museum in Chino, California. The 19-year-old who recognized in 1948 an aircraft that few would know even today (the owner of the storage facility thought it might be some kind of boat) was Ed Maloney. The Shusui, which had been captured by U.S. forces and brought to the States, became the first artifact in his now world-famous collection

of 150 aircraft. A Mitsubishi team traveled to Chino to measure Maloney's Shusui so they could complete the restoration of their airplane.

On certain days of the week, a visitor is likely to spot the tall, erect figure of Edward T. Maloney busying himself around the Planes of Fame museum, chatting with visitors, or rearranging some of the hundreds of finely crafted scale models of aircraft in glass cases that line the

BY MARSHALL LUMSDEN

sides of some of the hangars. Many of the models, which depict the evolution of aircraft from the 1903 Wright *Flyer* through the Lockheed Martin F-22, were created by Maloney himself.

"I had been building models since I was seven years old," he recalls. "I remember the Jimmy Allen club, used to be on radio. Richfield Oil sponsored them Monday through Friday. You could send in and become a member and they would send you pictures and things like that."

Maloney was one of the first to see the need to save historic airplanes. A high school student during World War II, he was too young for the military, but he joined the Civil Air Patrol and learned to fly. In 1946, when he was a high school senior, he made a trip to Cal-Aero at the Chino airport, one of the largest collec-

Among the first to see the historical value of aircraft, Ed Maloney opened a museum in 1957 and has been adding airplanes ever since, like the Hawker Hurricane (at left) and LK-10A glider. What makes the Planes of Fame Air Museum especially thrilling to airplane fans is aircraft that fly. Right: The museum's 1932 Boeing P-26A Peashooter buzzes Chino, California.



PHILIP MAKANNA/GHOSTS



A Douglas AD-1 Skyraider (wings folded) dominates a hangar at the museum's Valle, Arizona location, where visitors are greeted by an eagle sculpture and a Lockheed Constellation (opposite).

tion points in California for surplus military aircraft. That same year, he had seen William Wyler's Academy Award-winning film *The Best Years of Our Lives*. Wyler had filmed a sequence at Cal-Aero, in which rows of abandoned, engine-less World War II airplanes symbolize returning airmen and soldiers who were lost in civilian life, victims of American indifference. The scene made a powerful impression on Maloney. And what he saw at Cal-Aero—row after row of airplanes being auctioned to scrappers by the hundreds—cemented his determination to save as many examples of warplanes as he could.

Maloney is ordinarily even-tempered,

but his voice tightens with anger and disgust when he describes how the airplanes were melted down to be sold as scrap aluminum. "They made ingots out of them," he recalls. "They'd just stack them up with forklifts as high as a building. It was just mind-boggling." Later, he spoke of the recycling going on today at the Davis-Monthan Air Force Base boneyard in Tucson, Arizona: "I go down there and it makes me sick. They don't smelt them anymore. They have a new machine down there now; it nibbles the parts off airplanes. It's a terrible sight to see an airplane nibbled to death."

In 1948, while he was working in his father's automobile repair shop, Maloney bought the Shusui for the cost of its unpaid storage charges. "I wanted to start a museum," he says. "Somebody had to start it or it wouldn't get done." Almost 10 years later, he opened one in Clare-

mont, California. Last year, it celebrated its 50th anniversary.

"I charged a dollar admission," Maloney says of the early years. "Of course, I had the model collection and engines on display, all kinds of aeronautical items in showcases." Besides the Shusui, Maloney had bought a 1928 Boeing P-12E, a U.S. Army biplane fighter with an all-metal fuselage; a Japanese rocket-powered kamikaze Ohka; and, today one of the most famous flying aircraft in the collection, a Northrop N-9MB Flying Wing. (It became airworthy in 1994; see "And Then There Was One," Feb./Mar. 2007.) "We also had a Bell P-59 and a Chanute glider," Maloney says. "Got the doors open anyhow. It was always my intention to have flyable aircraft, but that would have to come later because we didn't have a cadre of pilots at that time." Today, about a third of the museum's aircraft are flyable.

For his first purchases, Maloney paid scrap prices. "Aluminum was going for 25 or 30 cents a pound," he says. "At the time, P-51s were going for fifteen hundred dollars." He bought airplanes as well as bits and pieces of airplanes. In the 10 years before he opened the museum, he stored his collection in his own back yard and wherever else he could find space.

Six years passed after the opening before Maloney could devote his full time to the museum. "I held two jobs," he says, recalling the day job in his dad's shop. "I worked nights and weekends on the airplanes. I hired a retiree to keep the muse-

The first airplane Maloney bought, the Mitsubishi J8M1 was being developed in 1945 Japan to counter U.S. bombers.



um open during the days. I didn't take any salary. The museum paid for the rent and the electric bill, primarily."

Meanwhile, he made some trips to study what other museums were doing and was discouraged by what he saw. He visited the Smithsonian, which he recalls had some interesting airplanes in an old Quonset hut on the National Mall. He visited the Franklin Institute in Philadelphia. The Air Force museum in Dayton, Ohio, hadn't opened by that time. "Everybody was pretty short on aircraft," he recalls.

He was especially dismayed by the Los Angeles County Museum of Science and Industry. "Here we had the largest production center for aircraft in the country," he says, "and they had three airplanes down there at the L.A. County museum. They had a guy who was director of aeronautics and they buried him in the basement. I went down to visit him and they had a Sopwith Snipe from World War I on loan from the movie actor Reginald Denny. The only other aircraft they had on display was a Douglas World Cruiser. The third one was a Curtiss HS2L flying boat. They left it outside and it finally rotted."

At the time, in fact, Maloney's little collection was the only real air museum west of the Mississippi. Aviation photographer Frank Mormillo remembers the early days: "There was an article in one of the Los Angeles papers with a picture of Ed. This was 1957. I didn't have a driver's license yet, so my dad drove me to Claremont. It was basically a dirt lot with a bunch of rocks. It wasn't really a building, it was a flat concrete slab with corrugated metal sides that went about halfway up to a metal roof with netting the rest of the way."

Mormillo, who still volunteers as a media consultant, speaker, and sometime master of ceremonies for museum events, recalls, "You went in through a B-29 nose section and there was Ed sitting behind the seat. If you went to Ed's house, which was just a few blocks away then, you would have seen pieces of airplanes in his back yard and in his garage, full from

floor to ceiling with all sorts of rubbish. Literally, at that time the P-47, the P-51A, the P-40, and the P-59 were all disassembled in the back yard."

Maloney continued to scrounge and scramble for rare aircraft wherever in the world he could find them. (After a five-year search, he tracked down in Guatemala a Boeing P-26A Peashooter, the first pursuit monoplane flown by the U.S. Army Air Corps.) In 1963 he moved the museum to nearby Ontario International Airport, and in 1970 moved the airplanes to Buena Park, California, near Disneyland, to complement a collection of Hollywood automobiles. To match the jazzy "Cars of the Stars," Maloney coined the name "Planes of Fame." When in 1973 the museum moved to its present location at Chino, the name stuck. In 1995, a second facility opened, in Valle, Arizona, where 35 airplanes are on display.

Meet the Airplanes

A walk around the museum with Ed Maloney is a history lesson in airplanes, even for someone who thinks he knows something about aviation.

"On the other side of me, you see this big biplane," Maloney points out in the foreign-aircraft hangar. "That's a Russian An-2. The North Vietnamese used them in the war to bring supplies down to the south. Had an F-101 pilot in here not long ago, and he said he was looking down one day and saw one of these land on the highway. They opened the door and kicked out all the guns and ammunition and just took off again and headed back for Hanoi.



We acquired this one [from a civilian government operation in Hungary] and had it dismantled and shipped over. We flew it for a number of years. It's amazing that they're still being used in some of the communist countries as transports, dusters, sprayers"

We move on to a Korean-era fighter. "And this Yak-18 is called 'Bed Check Charlie.' They'd throw out hand grenades or whatever bottles they had to make noise to keep our troops awake at night. The only Navy ace in the Korean War shot down five of these flying a Corsair F4U-5NL. There's still a few flying in Europe, but they're kind of rare."

We stop at a little biplane, a Hanriot Scout.

"Here's the first World War I aircraft we acquired," he says. "It belonged to the third-ranking French ace, Charles Nungesser. When the war was over, he brought this and several other airplanes over to do a little barnstorming. In 1925, he did a motion picture at Roosevelt Field called *The Sky Raider*. The pilot of the photography airplane, I found out years later, was Igor Sikorsky."

On completion of the movie, Maloney tells me, the producers of *The Sky Raider* hired Nungesser to perform aerial stunts to promote the film across the country.

FIND OUT MORE
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FOR MORE ON THE PLANES OF FAME museum's collection of racing airplanes, visit www.airspacemag.com.



For a 1993 photo shoot, two friends, Steve Hinton and John Maloney, reenacted a battle between old adversaries, the Lockheed Lightning and Mitsubishi Zero. (Today, the Lightning wears olive drab.)

At the end of the tour, he stored the airplane at the Santa Monica airport, which was then Clover Field, and returned to France to prepare for an attempt to fly across the Atlantic. He disappeared during the flight.

“When I was just a kid in grade school, I remember seeing the Hanriot Scout,” says Maloney. “They’d do movies like *Men With Wings*, *Tailspin Tommy*, and *Hell’s Angels*, and the theater would rent this plane and put it in the foyer. I got to thinking back in the early ’50s and I said, Gee, I remember that airplane. That’s got to be around here someplace. It had a skull and crossbones on the side.”

Then Maloney did what has led him to many an airplane since: He started “asking around.” He found that the owner had died and that the airplane now belonged to his wife, who had stored it in a warehouse, and was willing to sell. “So I bought it from her and assembled and restored it,” he says.

Keep ‘em Flyin’

In a fenced lot outside one hangar sits a B-17 without its war paint. The last active Flying Fortress in the U.S. Air Force, *Piccadilly Lilly II* retired in 1959. “This is the B-17 that was used in the television series ‘Twelve O’Clock High’ years ago,” Maloney says. “We’d like to put it back in the air, but we’ve only raised enough money to paint it.”

The museum stopped flying it in 1975. “It’s a lot of work,” Maloney says, “and we just have so many mechanics and we keep quite a few airplanes flyable so we just decided to park it for a while and then come back to it.”

Still, it’s the flying aircraft and the experience of seeing and hearing them come alive again that make the museum so remarkable. Over the years, former B-17 crew members—pilots, crew chiefs and gunners—have showed up to hang around

and reminisce about the missions they flew. The sights and sounds and smells of working aircraft renew powerful memories of what it was like back then. For younger visitors, flying aircraft create an experience that static displays or history books could never match.

One of the museum’s finest possessions is the Mitsubishi A6M5 Zero fighter, the only flying A6M5 with the original Naka-

The Fighter Rebuilders team reassembles a P-47D Thunderbolt that had been shipped from Duxford, England, in 2006.



FRANK MORMILLO



The new “Chino kid” on the block, Steve Hinton Jr. (at right) is following in the footsteps of his famous dad.

jima Sakae 31 engine, a 14-cylinder radial that produces 1,200 horsepower. “About 12 of them were captured on Saipan in June 1944, along with some spare engines and parts,” says Maloney. The Navy brought the aircraft back to the United States, gave half of them to the U.S. Army Air Forces, and restored four of them for flight tests. Maloney bought it from a scrap dealer. There were no documents with it, but while he was stripping paint from the aft tail, he found a number—61-120—and started piecing together its story. The number was the designation of the Japanese military naval air group.

“I’ve done all the history on it,” says

to fly these airplanes. They could also fly the Navy fighters so they could compare performances. Charles Lindbergh flew it at Patuxent River Naval Air Station in Maryland in October 1944.” Maloney also corresponded with the aircraft’s designer, Jiro Hirokoshi. The museum has taken the Zero to Japan on three occasions to fly it for audiences there, the first time in 1978 for a ceremony to honor the souls of departed military pilots. Most recently, the museum also took a P-51 Mustang along to show them together.

For his efforts at preserving aviation history, Maloney was inducted in 2001 into the Experimental Aircraft Association’s Hall of Fame. In 2006, the Society of Air Racing Historians honored his collection of racers by awarding him the Cliff Henderson award, named for one

Maloney, “and I even have the logbook from the Navy. They invited all the leading test pilots from Northrop, Boeing, North American, Grumman, Ryan, and Convair

of the founders of the Cleveland Air Races.

As the years went by, the airplanes Maloney had bought at scrap or bargain rates became rare, and well-heeled trophy hunters entered the collecting game. Prices soared. Although Maloney has never let up in his 50-year “treasure hunt,” as he sometimes calls it, the competition has gotten much stiffer for a museum that often had to struggle to stay in business. Inevitably, some prizes slipped through his fingers.

“Found a biplane P-6E Hawk advertised. I would liked to have bought it but didn’t have the money,” he says. “Of course, the Air Force Museum in Dayton had some wealthy friends, and they purchased it. That’s a rare one.

“You don’t get to collect everything you’d like to get. We can’t complain. We have a pretty good collection. Visitors come from all over the world to see the aircraft. We’re a little off the beaten path here, but we like it in a way because we can still fly here.”

Each month the museum hosts a seminar related to its aircraft – in this case, the F4U Corsair (at left) and A-4 Skyhawk.



All in the Family

The organizational chart for the museum looks a little like an abbreviated Maloney family tree. “It didn’t start out to be a family operation,” Maloney says. “I founded it and had two sons. I said, ‘Well, if you don’t want to fly, you don’t have to fly.’ They came out and started washing airplanes and sweeping the floors just like anybody else, and they ended up staying in the business.”

Jim Maloney, the older son, started hanging around the museum when he was seven. He brought along his best friend in the second grade, Steve Hinton. “What did I do when I was seven? I picked up Coke bottles and made a mess,” Hinton recalls. But, with the younger son, John, the boys grew up around the airplanes. They washed and painted them and picked up mechanical experience. Eventually, they learned to fly, first the Stinson L-5, then the North

Since 1990, Steve Hinton has flown a museum Lockheed T-33 as the pace plane at the Reno air races. To keep up with today’s faster racers, the museum got a new T-bird (not shown) with the more powerful Rolls-Royce Nene engine.

American T-6 and the P-51. They flew warbirds for the television series “Baa Baa Blacksheep” in the early 1970s and, as their reputations as performers grew, became known among the aviation cognoscenti as “the Chino kids.” After a brief stint as an airline pilot, Hinton came back to Chino to found Fighter Rebuilders with Jim Maloney. In 1983, Maloney died when a Ryan PT-22 in which he was a passenger went into a spin during an aerobatic maneuver in Arizona.

Hinton’s career as a movie pilot, holder of a world speed record, and championship racer (he now flies the Planes of Fame T-33 as the pace plane at the Reno air races every year) has made him famous in aviation circles. He is one of the world’s most experienced pilots of vintage warbirds, having racked up hours in everything from a Sopwith Camel to a Northrop F-5B.

His company, Fighter Rebuilders, located at the museum, has restored aircraft for collectors such as Bob Pond, whose airworthy warbirds are displayed at the



FRANK MORMILLO

One of the museum’s hardest working aircraft, a B-25 Mitchell, doubles as an airshow attraction and camera platform.

Palm Springs Air Museum in California, and Stephen Grey and his Fighter Collection at Duxford, England. With such clients, the company is able to maintain a full-time crew the museum could not otherwise afford.

Hinton, who joined the family formally by marrying Ed Maloney’s daughter Karen, is now president of Planes of Fame; Karen works as director of development. Their 19-year-old son Steve Jr. appears to be following in his father’s footsteps. He flies the T-6 and late last spring he checked out in the P-51.

The museum supports itself with private donations from corporations and individuals, movie and airshow work, admissions and gift shop sales, and annual dues from memberships. One of the lures of membership is the possibility of a winning ticket in drawings for rides in one of the rare warbirds.

But much of the vitality of the museum comes from its corps of volunteers, all of whom share Maloney’s passion for historic aircraft. Volunteers do most of the restoration work. An eight-person team, for example, has spent every Saturday for 11 years working on the Bell P-59 Airacomet, the first U.S. jet fighter (see “Restoration,” Aug./Sept. 2005). According to volunteer Bob Velker, who describes himself as a “recovering engineer,” there are half a million rivets in the wings alone. “We’ve got about 40,000



DOUG FISHER/WARBIRD DEPOT

BRITT DIETZ



man-hours in it right now," he says.

The museum hopes to have the P-59 flying by May.

Then there will be another project to fit in between the museum's regular attractions. On the first Saturday of every month, the museum holds an event usually combining a seminar with one or more demonstration flights. A recent Saturday program on naval air power featured the F4U Corsair, and a later event on "Remembering Wake Island" will include the Japanese Zero.

Each mid-May, Planes of Fame holds a two-day airshow, which is arguably the world's most spectacular aerial display of rare warbirds from all generations. It features aircraft from other collections as well as those from the museum. Last year's 50th anniversary show drew a record crowd of about 25,000. Where else, after all, can aviation fans still see three Lockheed P-38 Lightnings flying in formation?

And a new education facility for young people is in the works. Karen Hinton, who is raising the money to complete it, describes it as a hands-on learning center, organized to illustrate different eras of aviation with remote cameras that can relay images of airplanes in the museum, a flight simulator as well as a control tow-

er simulator, and a working wind tunnel, among other features. The wind tunnel is now under construction.

A Quonset hut at the north end of the tarmac will house a new display to open later this year with artifacts and memorabilia from the 475th Fighter Group, a P-38 outfit based in the South Pacific. Charles Lindbergh flew combat missions with the group as a civilian pilot during the war.

Ed Maloney, his passion for collecting as strong as ever, dreams of more hangars to protect more airplanes. Recently, he

Navy warbirds convene for fans at the 2004 Planes of Fame airshow. Below: The newest display hangar in Chino is already packed to the rafters with airplanes. Deke Slayton's Formula One racer (red, with black stripes) is tucked behind the Gee Bee.

stood in a hangar doorway gazing up at Steve Hinton pulling a P-38 through a steep 360 overhead. Does he ever get tired of watching these airplanes fly? I asked him. A "What, are you crazy?" smile came over his face.

"Never," he said. —



FRANK MORMILLO

AIR AMERICA'S BLACK HELICOPTER

HOW THE CIA TAPPED THE PHONES IN NORTH VIETNAM.

by James R. Chiles



BLACK HELICOPTERS ARE A FAVORITE FANTASY when conspiracy theorists and movie directors conjure a government gone bad, but in fact, the last vehicle a secret organization would choose for a stealthy mission is a helicopter. A helicopter is a one-man band, its turbine exhaust blaring a piercing whine, the fuselage ski's vibration rumbling like a drum, the tail rotor rasping like a buzzsaw.

In the last dark nights of the Vietnam War, however, a secret government organization *did* use a helicopter for a single, sneaky mission. But it was no ordinary aircraft. The helicopter, a limited-edition model from the Aircraft Division of Hughes Tool Company, was modified to be stealthy. It was called the Quiet One—also known as the Hughes 500P, the “P” standing for Penetrator.

Just how quiet was the Quiet One? “It was absolutely amazing just how quiet those copters were,” recalls Don Stephens, who managed the Quiet One’s secret base in Laos for the CIA. “I’d stand on the [landing pad] and try to figure out the first time I could hear it and which direction it was coming from. I couldn’t place it until it was one or two hundred yards away.” Says Rod Taylor, who served as project engineer for Hughes, “There is no helicopter today that is as quiet.”

The Quiet One grew out of the Hughes 500 helicopter, known to aviators in Vietnam as the OH-6A “Loach,” after LOH, an abbreviation for “light observation helicopter.” The new version started with a small research-and-development contract from the Advanced Research Projects Agency (now the Defense Advanced Research Projects Agency) in 1968. The idea of using hushed helicopters in Southeast Asia came from the CIA’s Special Operations Division Air Branch, which wanted them to quietly drop off and pick up agents in enemy territory. The CIA bought and then handed over two of the top-secret helicopters to a firm—by all appearances, civilian—called Air America. Formed in 1959 from assets of previous front companies, Air America was throughout its life beholden to the CIA, the Department of State, and the Pentagon.

The Quiet One’s single, secret mission, conducted on December 5 and 6, 1972, fell outside Air America’s normal operations. The company’s public face—what spies might call its “legend”—was that of a plucky charter airline delivering food and supplies to civilians in Laos, and flying occasional combat evacuation missions in Laos and South Vietnam. While it did substantially more than that, and at considerable peril (217 of its employees died in Laos), Air America crews did not make it a practice to fly deep into North Vietnam.

At a secret base in Laos, Air America’s Thomas “Shep” Johnson (opposite) trained local commandos to set a wiretap. U.S. pilots flew them to the wiretap site, far behind enemy lines.

The mission was intended to fill an information gap that had been galling Henry Kissinger, secretary of state under President Richard Nixon. Negotiations to end the 11-year war had begun in March 1972 but stalled in part because South Vietnamese leaders feared that North Vietnam would invade not long after U.S. troops left. A five-month Air Force and Navy bombing campaign called Operation Linebacker had brought the North Vietnamese to the negotiating table in Paris that October, but even that campaign could not force a deal. Kissinger wanted the CIA to find out whether the North Vietnamese were following the peace terms or just using them as a smoke-screen for attack plans.

From its intelligence work a year earlier, the CIA knew about a weak point in the North Vietnamese wall of security: a telephone line used by the country’s military commanders, located near the industrial city of Vinh. A patrolled bicycle path ran alongside the string of telephone poles, but at one spot, about 15 miles southwest of Vinh and just east of the Cau River, the phone line went straight up a bluff, over a ridge, and down the other side. The terrain was too steep for bikes, so the path followed the river, which flowed around the bluff, rejoining the telephone poles on the bluff’s far side (see hand-drawn map, p. 67). This would be the best place to drop off commandos to place a wiretap.

Because the Vinh tap would be sending its intercepts out of North Vietnam, across Laos, and into Thailand, it would need a solar-powered relay station that could catch and transmit the signal, broadcasting from high ground. The station would be within earshot of enemy patrols, so both the tap and relay would have to be dropped in by helicopter—a very quiet one.

DISTURBING THE PEACE

The Hughes Tool Aircraft Division had started working on such a helicopter in 1968; that year an affluent suburb of Los Angeles had bought two piston-powered Hughes 269 helicopters for police patrols. Citizens soon called to complain about the noise of the low-flying patrols, and the city told Hughes to either make them quieter or take them back. An emerging market for police patrols was at stake. Engineers at Hughes identified one of the worst of the noisemakers: the tail rotor. By doubling the number of blades to four, Hughes was

THE MISSION WAS INTENDED TO FILL an information gap that had been galling Henry Kissinger, then secretary of state. Kissinger wanted the CIA to find out whether the North Vietnamese were following the peace terms or just using them as a smokescreen for attack plans.

able to cut the speed of the rotor in half, which reduced the helicopter's noise.

Coincidentally, the Advanced Research Projects Agency was hunting for contractors who could cut noise from military helicopters of all sizes. After hearing about Hughes' work on the police helicopters, ARPA offered the company \$200,000 in 1968 to work similar magic on a Hughes OH-6A light helicopter. Hughes Tool made a short movie about the modifications, which included a new set of gears to slow the tail rotor, and showed it to ARPA. "ARPA came back and offered a blank check to do a Phase Two of the program with no holds barred," recalls Taylor, the project engineer. "Each and every noise source in the helicopter was to be addressed in an attempt to reduce the signature to an absolute minimum." ARPA gave the project the code name Mainstreet. Even before work was fully under way, the CIA ordered two (later registered as N351X and N352X) for use in the field. Test flights began at Culver City, California, in 1971, followed by a brisk training program for the U.S. instructor-pilots who would later train mission pilots.

Flights of the Quiet One included low-level work at the secret Air Force base Area 51 in Nevada and touchdowns on peaks in California to familiarize pilots with close-quarters maneuvering and landing in darkness. Pilots needed at least eight hours to get comfortable with steering by sole reference to the comparatively narrow view of the forward-looking infrared (FLIR) camera, which was mounted just above the skids. Says Allen Cates, an Air America pilot who flew one in 1973: "When you saw a person, it was like looking at a photo negative. Or you'd see just the hood of a car, glowing from heat off the engine block.... And when you were landing, a blade of grass looked as big as a tree."

The slapping noise that some helicopters produce, which can be heard two miles away or more, is caused by "blade vor-

tex interaction," in which the tip of each whirling rotor blade makes tiny tornadoes that are then struck by oncoming blades. The Quiet One's modifications included an extra main rotor blade, changes to the tips on the main blades, and engine adjustments that allowed the pilot to slow the main rotor speed, making the blades quieter (see "How To Hush a Helicopter," p. 68). The helicopter also had extra fuel tanks in the rear passenger compartment, an alcohol-water injection system to boost the Allison engine's power output for short periods, an engine exhaust muffler, lead-vinyl pads to deaden skin noise, and even a baffle to block noise slipping out the air intake.

The extensive alterations did not blank out all noise, Taylor says. Rather, they damped the kinds of noise that people associate with a helicopter. "Noise is very subjective," he says. "You can reduce the overall noise signature and an observer will still say, 'I can hear it as well as before.' It's related to the human ability to discriminate different sounds. You don't hear the lawnmower next door, but a model airplane is easily heard. It has a higher frequency and seems irritating."

Hughes shipped the two Quiet Ones to Taiwan in October 1971. Under the CIA's original plans, the Vinh wiretap mission would be flown by pilots from the Taiwanese air force's 34th Squadron. This would offer the United States some deniability, however flimsy, if any of the helicopters were captured. The pilots' U.S. instructors included two veteran helicopter pilots with experience flying low-level missions in Vietnam: Lloyd George Anthony Lamothe Jr. and Daniel H. Smith. The two had joined Air America six months earlier for that purpose.

THE DECOYS ARRIVE

Meanwhile, Air America's fleet in Thailand accepted delivery of two more Hughes 500 models—standard ones—and used them for air taxi operations. The job of these plain-vanilla Loaches

was to distract attention from the Quiet Ones before they even landed in Laos. Loaches were common in Vietnam but not in Laos, so Air America needed to start using them in full view of North Vietnamese sympathizers. That way, if an enemy observer later saw the modified Loaches flitting past on a moonlit night, he might not consider the event worthy of comment.

Initial flight training on the Quiet Ones,

Six weeks after the wiretap was set, Secretary of State Henry Kissinger (third from right) squared off against North Vietnam's Le Duc Tho (fifth from left) at the Paris peace talks in January 1973.



GETTY IMAGES KEYSTONE/STRINGER

conducted in Taiwan, was complete by June 1972. The two helicopters and their gear traveled on a C-130 transport to an isolated airstrip in Thailand called LS-05. Mechanics pulled them out, swung the rotor blades for flight, and filled the tanks, and the two helicopters flew by night to an even more obscure base, a secret one in southwest Laos known to insiders as PS-44. PS stood for “Pakse Site,” a reference to the garrison town of Pakse, 18 miles to the southeast. PS-44 had been built to house Laotian commandos and the aircraft that flew them around. Its dirt strip and three tin-roof buildings sat on the edge of a plateau, surrounded on three sides by steep ground that was unusual for its expanses of bright beach-like sand, eroded from nearby cliffs of white sandstone.

It appeared to be far away from everything, but it was not far from the enemy. By late 1972, units of the North Vietnamese army were ensconced 20 miles to the north. To offer some peace of mind, the CIA had Air America keep a turbine transport helicopter, the Sikorsky S-58T “Twin Pack,” handy for evacuations. More reassuring, the terrain was so steep and overgrown that the enemy could have stormed it from only one direction: the west. The base also relied on a perimeter of six guard posts staffed by Laotian soldiers, and reinforcements could have been called in from a base lying southwest, along the Mekong River.

NO PICTURES ALLOWED

Cameras were discouraged at PS-44, and photographing the Quiet One was strictly forbidden. Crews already knew the risk of telling tales in the bars and brothels of Southeast Asia, but even inside the base, the code of silence persisted. “You just didn’t come up and introduce yourself at PS-44,” says Dick Cast-



The Quiet One had a forward-looking infrared (FLIR) camera on its belly that helped the pilots navigate at night. Below: Pilots viewed the terrain imaged by the FLIR on screens in the cockpit.



SHEP JOHNSON (2)

erlin, an Air America pilot who came to the base often. “Nobody talked about their personal background or where they were from.” Men who worked closely for months knew each other only by first names or nicknames. The CIA itself had its own nickname at PS-44: The men called it simply “the Customer.”

Casterlin flew an S-58T helicopter during some of the wiretap attempts, accompanying the Quiet One in order to rescue the wiretap teams if that became necessary. Casterlin had a security clearance for special missions, but even he wasn’t told where the CIA had hidden the Quiet One.

According to base manager Stephens, the Quiet One was kept out of sight about 600 yards northwest of PS-44’s main building, reachable down an unmarked, narrow forest trail. Because of the distance, the forests, and the quieting gear, the helicopter couldn’t be heard from the porch of the base’s main building unless it was flying overhead. Even then, at night, it sounded like a far-off airplane. The helicopter had its own hangar so Soviet spyplanes and satellites could not get a look at the peculiar profile produced

by the extra main rotor blade, a tail rotor with blades in an odd scissored configuration, and big muffler on the rear fuselage.

Between June and September, Lamothe and Smith tried to train the Taiwanese crews to fly the mission, but after months of poor performance by the trainees—including a botched night landing that demolished one of the two Quiet Ones—and bickering over who would be the chief pilot, the CIA managers got fed up and sent the whole contingent home. Lamothe and Smith prepared to fly the mission themselves.

At the same time, the agency placed the project under new management. James Glerum arrived in Pakse to direct operations. Glerum had been the CIA’s assistant base chief at Udorn Royal



DEPARTMENT OF DEFENSE

Thai Air Force Base when the Quiet Ones landed in Laos. The new assignment demonstrated how urgently the state department wanted the wiretapped information, according to Air America chief helicopter pilot Wayne Knight. Glerum, he says, was a CIA “super-grade,” outranking many careerists at headquarters.

Soon after his arrival, Glerum quizzed Smith and Lamothe on their cover story. When he realized they had none, he provided them with false identities and a story to go with them in case of capture.

More help came from Air America, which was offering up its best aircraft (the term used was “gold-plated”) and its most experienced men to support the mission. One was Thomas “Shep” Johnson, a rangy Idahoan with a background in smoke-jumping. Johnson had started with Air America in its first year, 1959, rigging bundles with parachutes and pushing them out of aircraft. A year before, he had been one of only three men to survive a North Vietnamese attack at another Laotian air base. Johnson’s main responsibility was to train a squad of eight Laotian commandos for the Vinh wiretap mission. For years, the commandos had been fighting communist forces and had reported on enemy traffic along the Ho Chi Minh Trail in eastern Laos. A group of 100, they lived in a separate part of PS-44 and manned the perimeter.

The CIA had hoped to get the wiretap in place before monsoon season, but a series of mishaps and equipment malfunc-

A Sikorsky H-34, here about to hoist a wingless Cessna O-1 Bird Dog, was a multi-mission helicopter in South Vietnam. One of the H-34 models, called an S-58T, escorted the Quiet One partway on its wiretap mission, in case a rescue was needed.

tions, compounded by the monsoons starting early, delayed the mission. “We had a string of unbelievably bad weather,” says Glerum. “Normally, November to January is the rainy season. It had started right as I got there [in October].” Twice Lamothe and Smith took off from PS-44 to fly the wiretap

mission, refueling in eastern Thailand and heading into enemy territory, only to turn back after running into clouds in the passes or fog at the wiretap site. “The preparation for the mission was a very hectic time,” says Stephens, “but it also seemed like it dragged on forever.”

TECHNICAL DIFFICULTIES

Hughes technicians toiled over the troublesome infrared camera; problems with it had forced cancellation of an October 21 attempt. “The FLIR [forward-looking infrared] required a lot of work,” recalls Glerum. Other gadgetry included SU-50 night-vision goggles (their first use in Laos), which worked only when the moon was a quarter to a half full. The helicopter also had a long-range navigation system (LORAN-C).

Any mishap during the night flight into North Vietnam, par-

ANY MISHAP DURING THE NIGHT flight into North Vietnam, particularly while maneuvering among trees and telephone poles, would doom the mission and probably its participants. By day, the Quiet One's pilots studied photos and maps of the target; at night, they practiced the operation at a secret training ground.

ticularly while the crew maneuvered among trees and telephone poles, would doom the mission and probably its participants. By day Lamothe and Smith studied photos and maps marking the stealthiest route to the target. By night they practiced by using LORAN to navigate from the hangar to a nearby training ground they called the Hole. The topography of the Hole was an "astonishingly accurate duplicate" of the actual wiretap site, according to Glerum. Flying into and out of it was "no problem in the daytime, [but] it could be a bugger at night," recalls Casterlin. Smith and Lamothe dropped the commandos near a simulated telephone pole (a tree stripped of branches and equipped with a cross arm) and flew to a pre-selected tree, where they laid out the radio rig called the spider relay.

The spider relay was to be deployed as the helicopter hovered over a tree. With its solar panels, electronics boxes, and antennas sprung open to a width of almost 10 feet, the relay perched atop the branches with a fishnet-like webbing. It was nearly impossible to see from the ground. The relay could be folded into a compact package that fit between the helicopter skids, but there was so little ground clearance left after it was attached, the pilots could land only on a hard, flat surface.

When each night's practice was complete, Lamothe and Smith flew back through the darkness to the concrete land-

ing pad, which was shaped like an old-fashioned keyhole. The approach to landing was memorable because the Quiet One used no landing lights; it relied on an infrared floodlight on the nose. The light cast an eerie, ruddy glow.

Some of the biggest threats to mission success came not from North Vietnamese army spies but from plain bad luck. One flight opportunity was lost when a scorpion bit a wiretap team commando, setting off an allergic reaction. On one of the training flights at the Hole, after Lamothe and Smith deployed the spider relay used for practice, it slid off the branches and crashed to the ground, with pieces scattering. Training for the mission could not proceed without the relay, and joyful speculation spread among the ranks: It would be a month or more until a new spider could come from the States, so the men could go on leave.

But no: Stephens flew to the spot by helicopter, slid down a rope, and helped technician Bob Lanning bag up the pieces. Back at camp, Lanning laid them out on a floor and said he could get the relay working if he had some new parts. "Jim Glerum sent a cable," says Stephens, "and in three days we had the parts

The Quiet One had its own hidden hangar a third of a mile from PS-44 (below). Right: Johnson's hand-drawn map of the wiretap site at Vinh. Far right: the route the Quiet One flew into North Vietnam.



SHEP JOHNSON (2)



JOHN MACNEILL

WITH THE MOON ENTERING THE FAVORABLE quarter- to half-moon phase, the rescue crews moved to a forward staging base in eastern Thailand, while the Quiet One and its pilots remained at their base in Laos. Another attempt was scheduled, amid rising doubts by Air America veterans that this was ever going to work.

by courier. Bob worked two and a half days, almost nonstop, and put it back together. So we only lost a few days.”

With the moon entering the favorable phase, the rescue crews moved to a forward staging base in eastern Thailand while Lamothe, Smith, and the Quiet One remained at PS-44. An attempt was scheduled for the night of December 5, amid rising doubts among Air America veterans as to whether the scheme would ever work.

That night, the Quiet One flew to a refueling base at the Thai-Laotian border, where it met a de Havilland DHC-6 Twin Otter with the Laotian commandos. Two commandos with guns and the wiretap equipment climbed aboard the Quiet One, and the rest stayed on the Otter with parachutes and more guns in case they were needed for a rescue. Accompanied by an armed Twin Pack flown by Casterlin and Julian “Scratch” Kanach, the Quiet One set course for the northeast. The Twin Pack broke away at the North Vietnamese border and took up a slow orbit over Laos, out of radar range but on call if needed. Despite the Twin Pack’s readiness to play the rescue role, security was as tight as ever. “I did the LORAN navigation, but I didn’t have the coordinates of the wiretap location,” Casterlin says. “I assumed they’d tell me if I needed to know, or maybe Scratch knew.”

Leaving the Ho Chi Minh Trail, and without being targeted

by the anti-aircraft defenses along it, Lamothe and Smith climbed to cross the Annamese mountains, then dropped to follow the nap of the earth, following streambeds when possible. When the pilots identified the wiretap spot, they hovered, and the two Laotian commandos jumped a few feet to the ground.

Lamothe and Smith then flew west across the Cau River to a 1,000-foot-high mountain to set the spider relay. Finding the ideal tree for the relay had taken months of intense photo-reconnaissance work. The tree had to be tall, on high ground with a clear view of the western horizon, and flat at the crown. An Otter orbited over a receiver relay, which was already in place atop another mountain halfway into Laos. Inside the Otter, technicians were watching an oscilloscope measure a test signal from the spider relay.

Meanwhile, the Laotian commandos at the wiretap site found that the poles were concrete rather than wood, so they couldn’t use their pole-climbing boots to get up them or a stapler to attach the antenna. The men shinnied up instead. After splicing into the phone wires, they put the tap in place; it was concealed in a glass insulator of the same color used on the French-built line. The commandos began taping up the short-range antenna and installing narrow solar panels atop the pole’s cross-arm. This would power the tap’s transmitter.

How To Hush a Helicopter

One of the key reasons a helicopter is noisy is a phenomenon called blade vortex interaction, in which a blade from the main rotor slaps against the swirling air, or vortex, that forms off the preceding blade. On the Quiet One, Hughes engineers installed an extra blade on the main rotor and an adjustable governor with which the pilot could slow the main rotor speed to 70 percent of normal. The modifications lessened the force with which blades and vortices collided, making the Quiet One about half as noisy as a comparable-size helicopter.

The blades on a helicopter’s tail rotor, which provides torque to counter the rotation of the main blades and keep the aircraft from spinning in circles, also produce noise, and at a higher frequency than the main rotor. The tail rotors were changed from the standard cross shape into a narrower scissors shape – the first time that was ever done for a helicopter. A scissors rotor breaks up the regularity with which the blades encounter other blades’ vortices, spreading out the harmonics of the sound produced.



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SHEP JOHNSON (2)

When Lamothe and Smith heard from the Otter that the Thai oscilloscope was getting a clear signal from the spider relay's transmitter, they threw a switch that released the last cables connecting the spider relay to the helicopter and flew the Quiet One to a streambed to wait for the commandos to finish attaching the solar panels. At the scheduled time, Smith restarted the helicopter's turbine; he picked up the commandos at the wiretap site and the team returned to Laos without incident. Those listening to progress reports at PS-44, Udorn, and the Lima 40A refueling site were pleasantly startled to hear that the crew was on its way back and the tap was in place without a firefight, recalls Wayne Knight.

"What makes the Vinh tap so special is that they pulled it off," Knight says. "It had to be right the first time."

DISAPPEARING ACT

Lamothe and Smith left the Quiet One at PS-44 and flew to the CIA's regional office at Udorn by conventional aircraft. Much celebration at ensued there—perhaps too much. During the subsequent R&R, someone at the Wolverine Night Club in town bit off part of Smith's ear. If a reprimand for attracting attention was ever entered in Smith's secret personnel file, it didn't matter: The CIA had no plans to send the Quiet One up again, and within a week all the Americans connected with the mission and their equipment were on their way out of Laos.

Recollections differ on how long the Vinh tap worked—perhaps one to three months—and why it went silent. But allegedly it yielded enough inside information from the North Vietnamese high command to help nudge all parties to sign a peace pact in late January 1973. Exactly what Kissinger eavesdropped on remains classified.

"I was not aware of any specifics Kissinger and company were looking for," Glerum says. "Since the land line [at Vinh] was understood to hold the command channel, virtually anything would have been welcome."

The one flyable Quiet One relocated to California. Air Amer-

It was rare for the Quiet One, designed for flight at night, to see the light of day. Right: A Laotian commando practices for the secret operation.

ica pilots Allen Cates and Robert Mehaffey trained on it at Edwards Air Force Base, achieving proficiency in early 1973. Then, before any special-mission training began, and with no explanation, Cates and Mehaffey were sent back to their old piloting jobs at Air America. Mechanics pulled most of the special features out of the Quiet One, and its trail of insurance and registration papers ends in 1973, after it was transferred to Pacific Corporation of Washington, D.C., a holding company used as a screen for CIA-backed companies and assets.

"The agency got rid of it because they thought they had no more use for it," says Glerum. At least one of the ex-Quiet Ones surfaced years later at the Army's Night Vision & Electronic Sensors Directorate in Fort Belvoir, Virginia.

But according to the participants, no more were built. It's puzzling why the CIA did not keep a stable of Quiet Ones, at least while the technology remained under wraps. And it remained a secret for more than two decades, until Ken Conboy and James Morrison told the story in their 1995 book *Shadow War*.

But there were valid reasons for dropping the Quiet One from the spymasters' catalog.

"In the long run, the 500P was not the best for setting wiretaps," says Casterlin. "It was not good for high-altitude work." It was a light helicopter and had to be loaded with gear that cut into its payload capability and operating altitude. The Twin Pack was much louder but also simpler to run and more powerful, so Air America used it for later wiretap missions in North Vietnam. At least one tap, placed on the night of March 12-13, 1973, was successful.

Some of the Quiet One's innovations did show up on later helicopters, including the Hughes AH-64 Apache, which has a scissor-style tail rotor. And Hughes engineers' interest in modifying the tips of the main rotor blades to cut the slapping noise caused by blade vortices has been taken up by other experts. Aerospace engineer Gordon Leishman and his team at the University of Maryland, for example, are developing a blade with curved tubes at the tip to divert the air, thereby countering vortex formation. But, thanks to its many unusual modifications, the 500P still holds the title that Hughes gave it in April 1971: "the world's quietest helicopter." —

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Brian Grote is a flight instructor with 20 years aviation experience. He also writes monthly columns on subjects pertaining to aviation.

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ARTICLE WRITTEN BY: BRIAN GROTE

Dear Brian,

I've been flying for over 20 years. My usual run is a Denver departure at 9pm, fly to Billings, on to Cheyenne and then back to Denver by 5am. I fly a King Air 350. I love my career and I pride myself on doing the best job I possibly can.

Last time out, however, I was making lots of little mistakes. I was cleared for the ILS Runway 35R into Denver, but I couldn't pick up ATIS. That's when I looked at my radios and noticed I had dialed in the wrong frequency. I glanced again and dialed in the right frequency. I continued through my checklist and set my Radar Altimeter to 5500 feet. I was ready to make my descent and start my approach. After the outer marker I glanced at my DH again and noticed that I had set my Radar Altimeter, 67 feet low. Luckily, I landed safely, bouncing the wheels just a little.

After a couple more days in the sky I could tell my eyesight was beginning to deteriorate. I knew I wouldn't be able to renew my first class medical if I didn't do anything about it. I was really worried and started asking my peers if there was anything I could do. A co-worker gave me a bottle of Claroxan™ and told me it would help me maintain my depth perception. I was skeptical at first, but tried it anyway. As it turns out, the stuff works great. The problem is, I ran out and don't know where to find more. Have you heard of this Claroxan™ stuff? Is it available in the States?

Jason, 46 – Seattle, WA

Jason,

Not only do I know of Claroxan™, it just so happens I take it everyday. Being a pilot myself, I know that perfect visual acuity is an asset none of us can afford to lose. That's why every pilot should be protecting their eyesight before it's too late.

Claroxan™ contains ingredients proven beneficial for the eyes. Among these ingredients are lutein and zeaxanthin – powerful antioxidants that have been clinically proven to protect the retina and macula and, in some cases, reverse the damaging effects of macular degeneration. These antioxidants block damaging UV rays and halt damaging free radical oxidation in the back of the eyes. They have also been clinically proven to decrease the risk of cataracts.

Claroxan™ also contains bilberry, an anti-oxidant known to improve night vision. Bilberry's night vision enhancing effects were first noticed in England in the early 1940's. The RAF ordered English fighter pilots to eat bilberry jam on toast figuring it would give them an advantage during night raid missions against the German Luftwaffe fighters.

Claroxan's unique proprietary formulation is completely safe, all-natural and extremely affordable. As far as ordering it, you can call them toll-free at 866.775.3937, or go to www.claroxan.com. I usually get mine within a week after ordering.

Hope this helps!
Brian

THE Himalayan CATARACT project

The Himalayan Cataract Project strives to eradicate preventable and curable blindness in the Himalayas through high-quality ophthalmic care, education, and establishment of a sustainable eye care infrastructure.

Based in Asia, at Kathmandu in Nepal, the Project is empowering local physicians to alleviate the suffering caused by blindness through unique programs including skills-transfer education, cost-recovery, research, and the creation of a world-class network of eye care facilities.

In 2004 and 2005, 3% of PacificHealth profits were donated to HCP for development and construction of eye facilities in the Himalayas.

Visit CureBlindness.org to learn more about HCP.



CLAROXAN™ | LEADER IN VISION IMPROVEMENT

Sunlight, aging, and diet each cause damage to the retina and macula, which can lead to a decline in vision that glasses or contacts can't help. If you've experienced an increase in blurriness or difficulty seeing details at any range, then you know how valuable sharp vision can be. What you might not know is that in the past three years, a flood of new scientific research has been done on natural vision enhancement. This medical research suggests that ingredients in Claroxan™ may help maintain and even improve your vision, while at the same time giving you added protection against many ocular diseases.

Claroxan™ may improve macular pigment density, which research shows has amazing effects on vision. By improving macular pigment density, ingredients in Claroxan™ may improve normal

visual acuity, contrast sensitivity, and even glare reduction. Participants in one clinical study reported that ingredients in Claroxan™ improved their long range vision outdoors – in some cases, they were able to distinguish far away ridges up to 27 miles further than normal! Even if you have perfect vision now, Claroxan™ may help give you an edge by improving your visual reflexes and may allow you to pick up on moving objects faster than ever before.

People who count on their vision – people like pilots, hunters, military, and even pro athletes – trust Claroxan™ as the best source available for vision enhancement and protection. Claroxan™ is safe, effective, and extremely affordable. However, people with serious health concerns should consult a doctor before use.

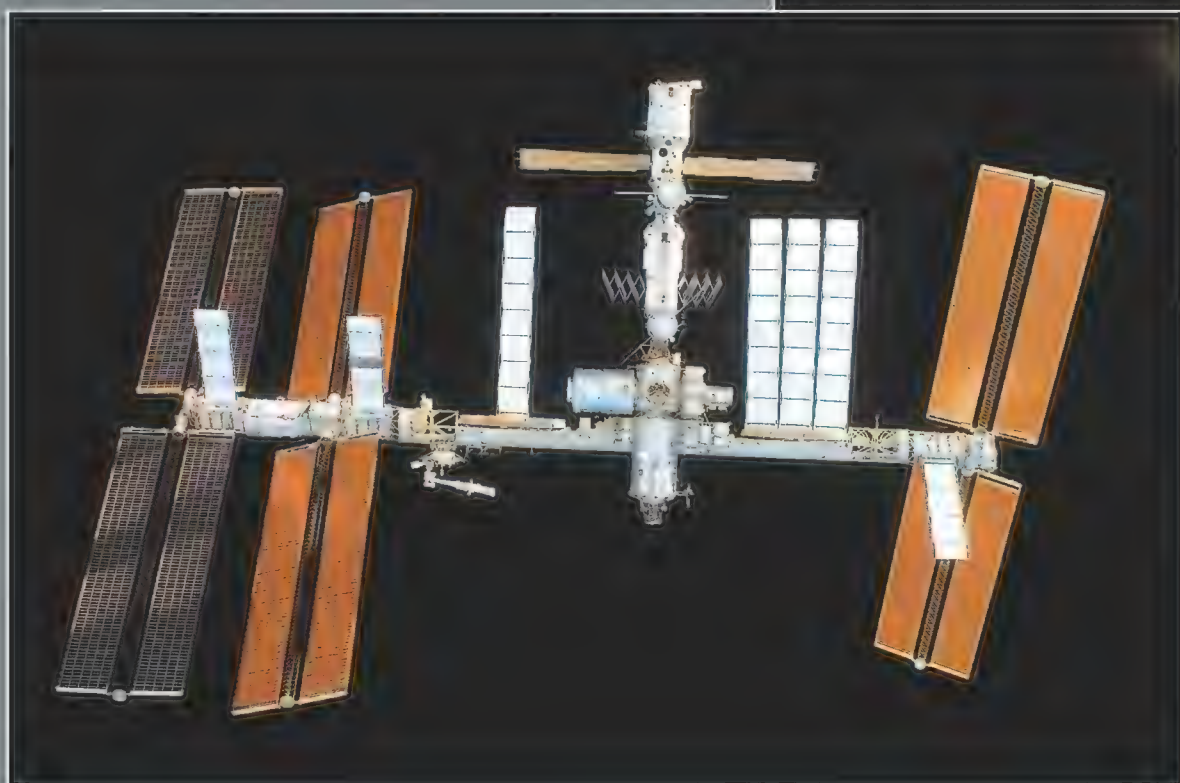


Sightings

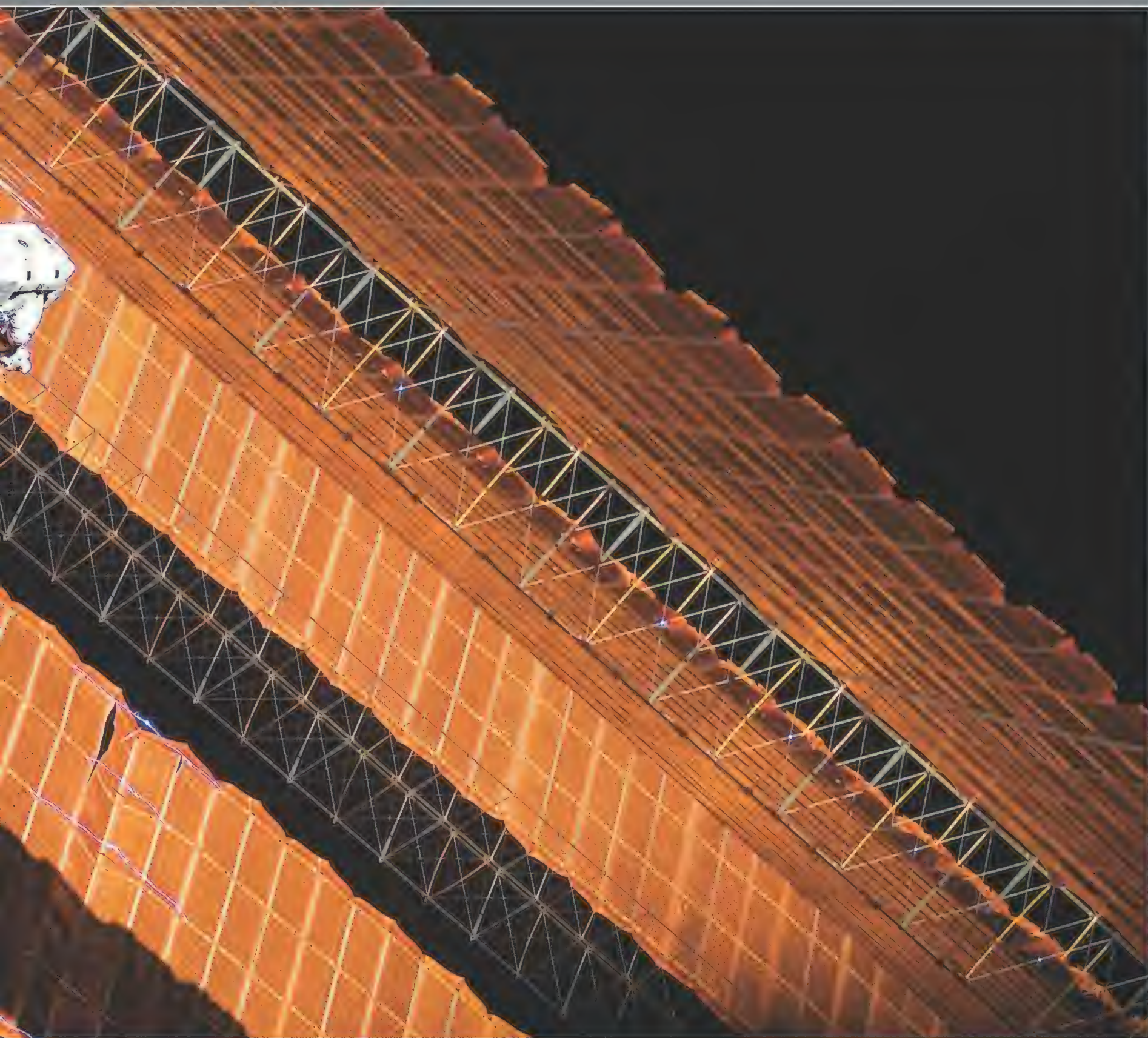
PICTURES WORTH A SECOND LOOK

"YOU NEVER COME face to face with a solar array" during training, marveled astronaut Scott Parazynski after his November 3, 2007 spacewalk to fix a damaged power panel on the International Space Station (right). Yet here was the five-time astronaut and three-time spacewalker standing at the end of a 50-foot boom attached to the station's robot arm, which together barely extended to the station's periphery. "Another foot beyond that and I don't think we could have reached it," he said. But reach he did. Then, holding two tools in one hand and taking care not to get tangled up or shocked, Parazynski managed to close a rip in the electricity-generating panels (bottom center of photo).

The fix prepared the way for European and Japanese lab modules to be delivered in early 2008. After 10 years as a largely U.S. and Russian effort, the station (below, seen from the shuttle *Discovery* after its departure; the repaired array at far left) is about to become a lot more international.



NASA (2)



Reviews & Previews

BOOKS, MOVIES, CDS, STUFF TO BUY

Women, Wings, and War

How female pilots won the right to fly military aircraft.

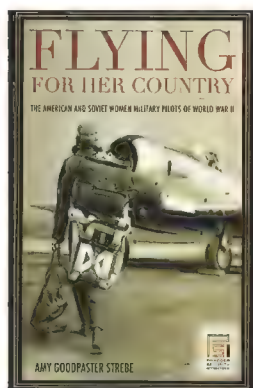


Flying for Her Country: The American and Soviet Women Military Pilots of World War II

by Amy Goodpaster Strebe. Praeger Security International, 2007. 109 pp., \$39.95.

AT THE END OF *Flying For Her Country*, Amy Goodpaster Strebe writes:

"By their courage, professionalism, and determination, the first female military pilots...succeeded at setting a precedent for subsequent generations



of women in aviation." It is a fitting closing tribute to those World War II pilots about whom she writes so well. Today, images of American women,

whether aircrew or maintainers, in airliners, combat aircraft, and spacecraft, are commonplace, but it wasn't always so. Strebe reminds us of the trials and bittersweet triumph of the Women Airforce Service Pilots, whose struggle for the right to fly and contribute mirrors in many respects that of the African-American Tuskegee airmen.

Women fighter pilots of the Soviet Union, including Lidiya Litvyak, Ekaterina Budanova, and Mariya Kuznetsova (left to right), were eager to defend their homeland against the German invasion.

Strebe also details Russian women pilots' search for acceptance in the Soviet Union's military.

Meticulously researched, well-written, and convincingly argued and documented, Strebe's book doesn't break new ground, but it does synthesize a great deal of scholarship and popular writing produced over the last three decades by aviation

TO ORDER THESE BOOKS FROM SMITHSONIAN SHOPS, CALL (202) 357-1387 OR -1388.



Robots in Space: Technology, Evolution, and Interplanetary Travel

by Roger D. Launius and Howard E. McCurdy. Johns Hopkins University Press, 2007. 334 pp., \$35.

Roger D. Launius, a curator of space history at the National Air and Space Museum, and Howard E. McCurdy, a professor at American University, survey the progress of robotic technology, a necessity for space exploration.

writer Sally Van Wagenen Kiel, Soviet expert Reina Pennington, and many others, including a number of biographies and memoirs from the women aviators themselves. One of the book's great strengths is a comprehensive bibliography that makes it particularly valuable as a reference for students and professionals alike.

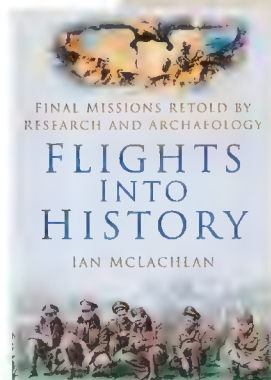
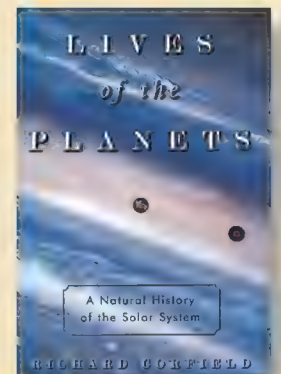
Strebe steers carefully between the "I am woman, hear me roar" exaggeration found in many popular accounts of women aviators and the equally wrong minimizing of their barrier-breaking accomplishments found in other works. As Soviet pilot Nadezhda Popova tellingly recounts in *Flying for Her Country*: "War does not spare anyone; it doesn't distinguish between the sexes."

Given its extremely brief length (excluding notes and bibliography, only 83 pages of text), it is puzzling that Strebe did not expand her book to include pre-World War II history, though she alludes to it in a brief and not-altogether-satisfactory introduction. In retrospect, that era was a period of critical importance, particularly for U.S. women aviators, as former National Air and Space Museum curator Claudia Oakes demonstrated over two decades ago in her book *United States Women in Aviation, 1930–1939*. Strebe's book could also have benefited from a broader international focus than just that of the wartime United States and Soviet Union. What, for example, of wartime Britain and Germany, two very dissimilar cases? Giles Whittell's

Lives of the Planets: A Natural History of the Solar System

by Richard Corfield. Basic Books, 2007. 268 pp., \$27.50.

Richard Corfield offers a comprehensive history of planetary exploration.



Flights Into History: Final Missions Retold by Research and Archaeology

by Ian McLachlan. Sutton, 2007. 204 pp., \$36.95.

By examining aircraft wreckage, the author tells the tales of such World War II military missions as the final flight of a British Mosquito.

Spitfire Women of World War II (a history of Britain's Air Transport Auxiliary that is far broader than its title indicates) and Evelyn Zegenhagen's breakthrough *Schneidige deutsche Mädel* ("Plucky German Girl," a tale of German female aviators in the context of the Weimar and Hitler era) are both evidence of the great range of materials and memoirs available for historical mining.

Finally, much remains to be written on the U.S. women beyond the WASPs: flight instructors supporting the Civilian Pilot Training Program, production test pilots such as Grumman's Cecile "Teddy" Kenyon and her colleagues, and engineers and "computers" such as Roxanah Yancey of the National Advisory Committee for Aeronautics, the predecessor of NASA.

Amy Goodpaster Strebe's book is excellent—as far as it goes. One hopes

that she will now turn her considerable talent to exploring further the subject of women in aerospace.

■ ■ ■ RICHARD P. HALLION, THE FORMER U.S. AIR FORCE HISTORIAN, IS THE 2007-2008 VERVILLE FELLOW AT THE NATIONAL AIR AND SPACE MUSEUM.

Secrets From the Tower

by Bob Richards. Ithaca Press, 2007. 368 pp., \$25.



REMEMBER THE EARLY '80S? When nearly everyone wore preppy clothes, Lynyrd Skynyrd wasn't considered classic rock, and President Ronald Reagan fired 11,000 air traffic controllers? Bob Richards does. That's when he reached the World Series, as he calls the control tower at O'Hare

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Reviews & Previews

International Airport in Chicago. In his memoir, *Richards, or Calvin*, as he's known around the tower (because he wore Calvin Klein jeans on his first day), describes the 22-year high he experienced working traffic at the world's busiest airport, while slowly crumbling under stress intense enough to kill lesser mortals.

During his off hours, Richards plies himself with booze and pills trying to re-create the adrenaline rush of shifts spent juggling O'Hare's insane numbers of airliners. On the job, Richards is not only competitive, but also an incorrigible clown. Among the escapades he recalls: On one late shift, he and another controller punish an incoming pilot for not asking for directions by allowing him to taxi his airliner aimlessly around the vacant airport. Though Richards likes to goof

around, he's too good to fire; in fact, when Bill Clinton flies into town, Richards is the tower's official Air Force One liaison.

Richards retires in 2007, after cardiac surgery. It's not his health that prompts his departure so much as it is administrative rot. "It just isn't fun anymore" is how a colleague sums it up. One straw that came close to breaking the camel's back: Just five months before Richards' exit, the Federal Aviation Administration dictates no more FM radios inside control towers. Considering that controllers handle billions of dollars' worth of jets and thousands of lives every day using ancient technology, don't they deserve a little classic rock on the boombox? "Freebird"!

PHIL SCOTT IS THE AUTHOR OF *HEMINGWAY'S HURRICANE*.

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Classic Carry On

DURING THE 1950S AND '60S,

Pan American World Airways gave its first-class passengers complimentary carry-on bags bearing the blue and white logo of the airline known for its routes to faraway lands. Carrying one was an advertisement of membership in the Jet Set. Today reproductions of the vintage bags are available from Pan Am One at www.panamone.com, which offers

16 designs ranging from \$52 to \$135. This bag, which goes for \$52, is made of vinyl, has metal zippers, and is lined with light blue cloth, making it easy to see the bag's contents. Ten inches wide, 10 inches tall, and three and a half inches deep, it's the perfect size for carrying a digital camera, cell phone, and a paperback or two.



Forecast

IN THE WINGS AND ON THE WEB...



Just as a male ballet dancer showcases his ballerina, the pilot's job is to showcase her wingwalker – at 3,000 feet and 200 mph.

IN THE NEXT ISSUE

ANNUAL AIR & SPACE AIRSHOW SPECIAL

Balancing Act: The dry-mouth terror of wingwalking – from the pilot's perspective.

Year of the Daredevil: They performed death-defying stunts before thousands of spectators, yet were forbidden to fly on Sundays or take female passengers aloft. Meet the 1910 Wright Exhibition Team.

PLUS

Let's Go to an Asteroid... before it comes to us.

Lockheed's Missing Link: While the XF-90 never made it into production, the cold war beauty paved the way for the F-104 Starfighter.

Coming to www.airspacemag.com: A "walkaround" of the Hawker Hurricane in the National Air and Space Museum; footage of the Schneider Trophy races; an article on Japanese space junk collectors.

Credits

Wings? Frail. Engine? Weak. Fly? Let's. Of all the aircraft Larry Lowe has flown, the Blériot was the most memorable.

Thai Boom. After a 20-year Navy career, Boom Powell now flies Learjets.

Anatomy of a Search. Michael Behar contributes regularly to *Outside* and *Wired*.

Who Says a Jet Can't Be Cheap? David Noland is a freelance aviation writer.

High Fashion. Bettina H. Chavanne is a Pentagon reporter for *Aerospace Daily & Defense Report*.

America the Cruisable. James Wynbrandt's 10th book, *A Brief History of Pakistan*, will be published this year by Facts on File.

Best of the Battle of Britain. Frequent contributor John Fleischman wrote about the U.S. 8th Air Force in the Feb./Mar. 2007 issue.

Satellite Smashers. Tony Reichardt is an *Air & Space/Smithsonian* senior editor.

Ed Maloney's Mission. Marshall Lumsden is a World War II pilot who flew several of the aircraft types represented in the Planes of Fame Air Museum, including P-40s, P-39s, and P-47s.

Air America's Black Helicopter. James R. Chiles is the author of *The God Machine*, a social history of helicopters.

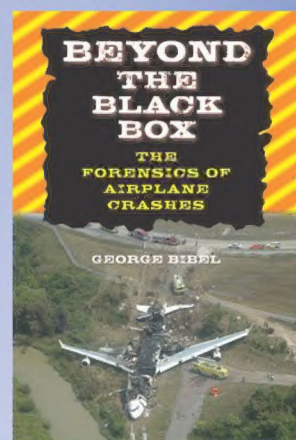
Pass the Popcorn. Roger A. Mola is an *Air & Space* researcher.

BEYOND THE BLACK BOX

The Forensics of Airplane Crashes

GEORGE BIBEL

Shows how crash investigators use physics, aerodynamics, and mechanical engineering to determine the probable cause of a crash and how resulting safety recommendations are incorporated to make flying safer.



ROBOTS IN SPACE

Technology, Evolution, and Interplanetary Travel

ROGER D. LAUNIUS AND HOWARD E. MCCURDY

Two leading scholars of space exploration expound upon the possibilities and improbabilities involved in trekking across the Milky Way and beyond. They offer a conclusion startling only to those who haven't spent time with Asimov, Heinlein, and Clarke: to traverse the cosmos, humans must embrace and entwine themselves with advanced robotic technologies.

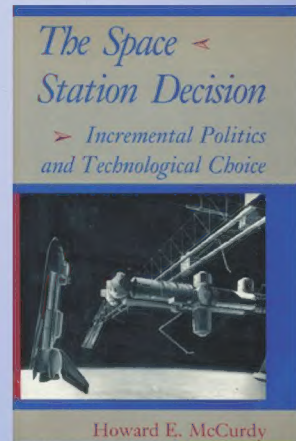


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Then & Now

FROZEN MOMENTS AS TIME MARCHES ON

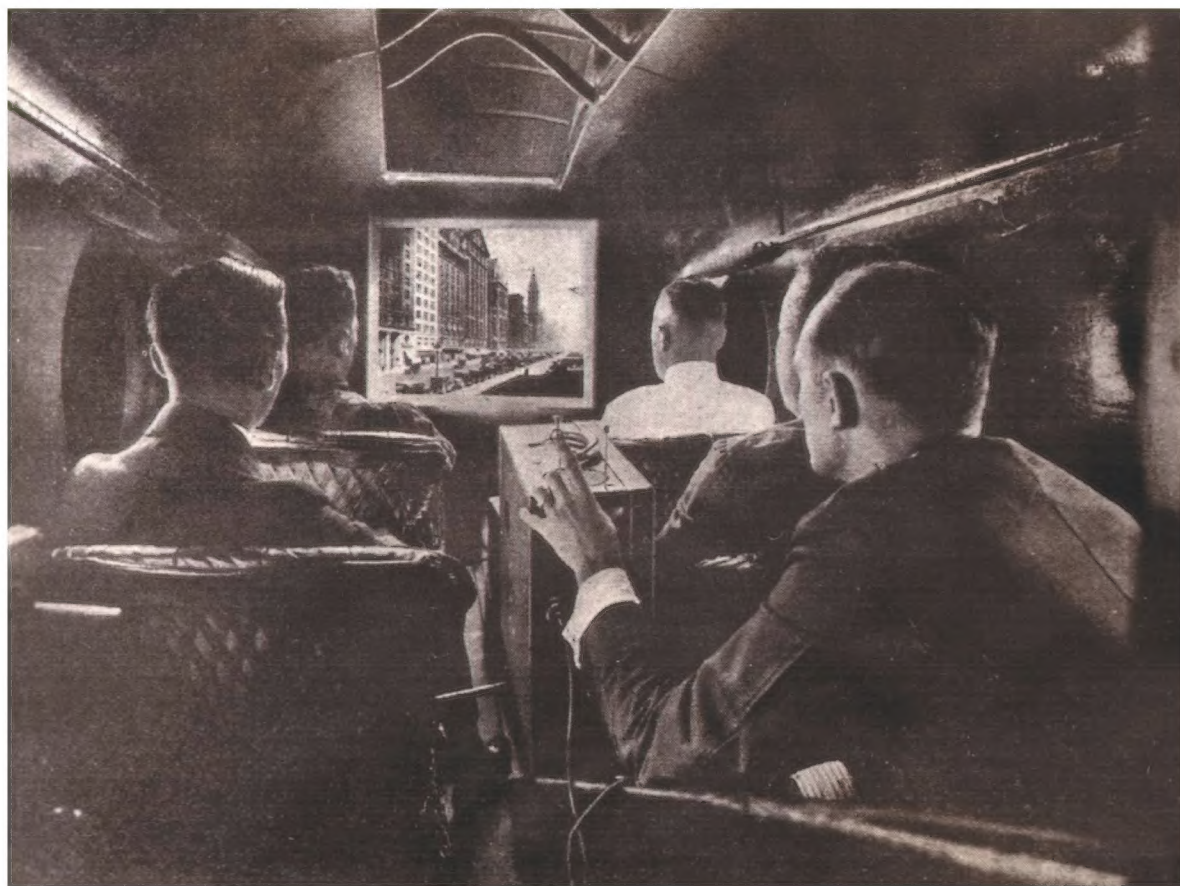
Pass the Popcorn

INFLIGHT ENTERTAINMENT began modestly—with a silent movie. In August 1921, while their Aeromarine Airways Model 75 amphibian circled over Chicago's lakefront, 11 passengers were treated to *Howdy Chicago!*, a short film put together by one of the city's booster clubs.

"This was more a promotional stunt than a regular offer," says Daniel Kusrow, an aviation researcher who runs a Web site about Aeromarine. Still, the World Airline Entertainment Association, which serves as a forum for inflight products and standards, considers it the birth of its industry.

Forty years later, TWA became the first airline to screen a movie on regularly scheduled service. Its choice of film in 1961, *By Love Possessed*, starring Lana Turner and Efrem Zimbalist Jr., was "risqué for that day," says John White, editor of *Avion*, the association's magazine. (The plot is based on an extramarital affair.)

If the movie is lousy, fliers on Airbus' A380 demonstrator can view its exterior from cameras on the fuselage and tail.



COURTESY DANIEL KUSROW

Throughout the 1960s, other U.S. airlines, along with a few foreign carriers, began adding movies.

Early systems were "bolted on" rather than integrated into the airplane, says Mike Sinnett, systems leader for Boeing's new 787 Dreamliner. Today's inflight entertainment runs through the same digital equipment, computer storage, and high-speed cables that the crew and ground support staff use to check the health of the aircraft's systems.

Emirates and Singapore airlines, which both fly the Airbus A380, have placed first and second, respectively, in the World Airline Awards' ratings of

best inflight entertainment. Singapore's system has a 10.6-inch seatback screen in economy class and a 23-inch one (and better headphones) in first class.

Passengers can choose from 100 movies, 180 TV shows, 20 radio channels, and 700

Aeromarine Airways used the DeVry "Theater in a Suitcase," invented in 1912, to air the first inflight movie.

music CDs. Or, they can thumb-play any of 91 video games.

Some airlines—including American Airlines' 767s on long-haul domestic flights—are testing more nimble, portable entertainment devices that flight attendants roll out on a cart.

While some passengers bring content with them, others rely on the airline to provide it, says Sinnett. "We'll probably see the push to carry a massive amount of content so passengers can choose what they want at any time," he says.

The World Airline Entertainment Association envisions that over the next decade, airliners will provide live satellite TV, personal cell phone calling, high-speed Internet service, and the capability for networking with colleagues or even group gaming. One option that probably won't make it: wraparound visors of the type used by virtual-reality gamers. Says Sinnett, who studied and dismissed such devices, "When people wear goggles on a moving platform, they tend to suffer motion sickness."

■ ■ ■ ROGER A. MOLA



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Calculus Is the Exploration of Two Basic Ideas. Master Them and Open a New World for Yourself!

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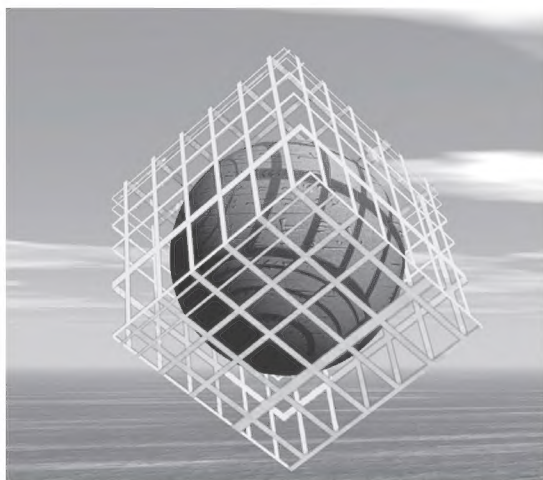
This series is not designed as a college calculus course; rather, it will help you see calculus around you in the everyday world. Every step is in English rather than "mathese." The course takes the approach that every equation is also a sentence that can be understood, and solved, in English.

About Your Professor

Professor Michael Starbird is a distinguished and highly popular teacher with an uncommon talent for making the wonders of mathematics clear to nonmathematicians. He is Professor of Mathematics and a Distinguished Teaching Professor at The University of Texas at Austin. Professor

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Starbird has won several teaching awards, most recently the 2007 Mathematical Association of America Deborah and Franklin Tepper Haimo National Award for Distinguished College or University Teaching of Mathematics, which is limited to three recipients annually from the 27,000 members of the MAA.

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Moments & Milestones

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The Unknown Aeronaut

"LEMAY AND NAVY BLIMP MAN Get Harmon Air Prize," read the headline in the November 13, 1958 *New York Times*. The writer knew General Curtis LeMay was a household name. The Air Force vice chief of staff was a World War II hero.

blimp, the *Snow Bird*, from South Weymouth Naval Air Station, in Massachusetts, and flew across the Atlantic, then south along the coastal waters of Europe and Africa to the easterly trade winds, then back to a landing at NAS Key West, Florida, on

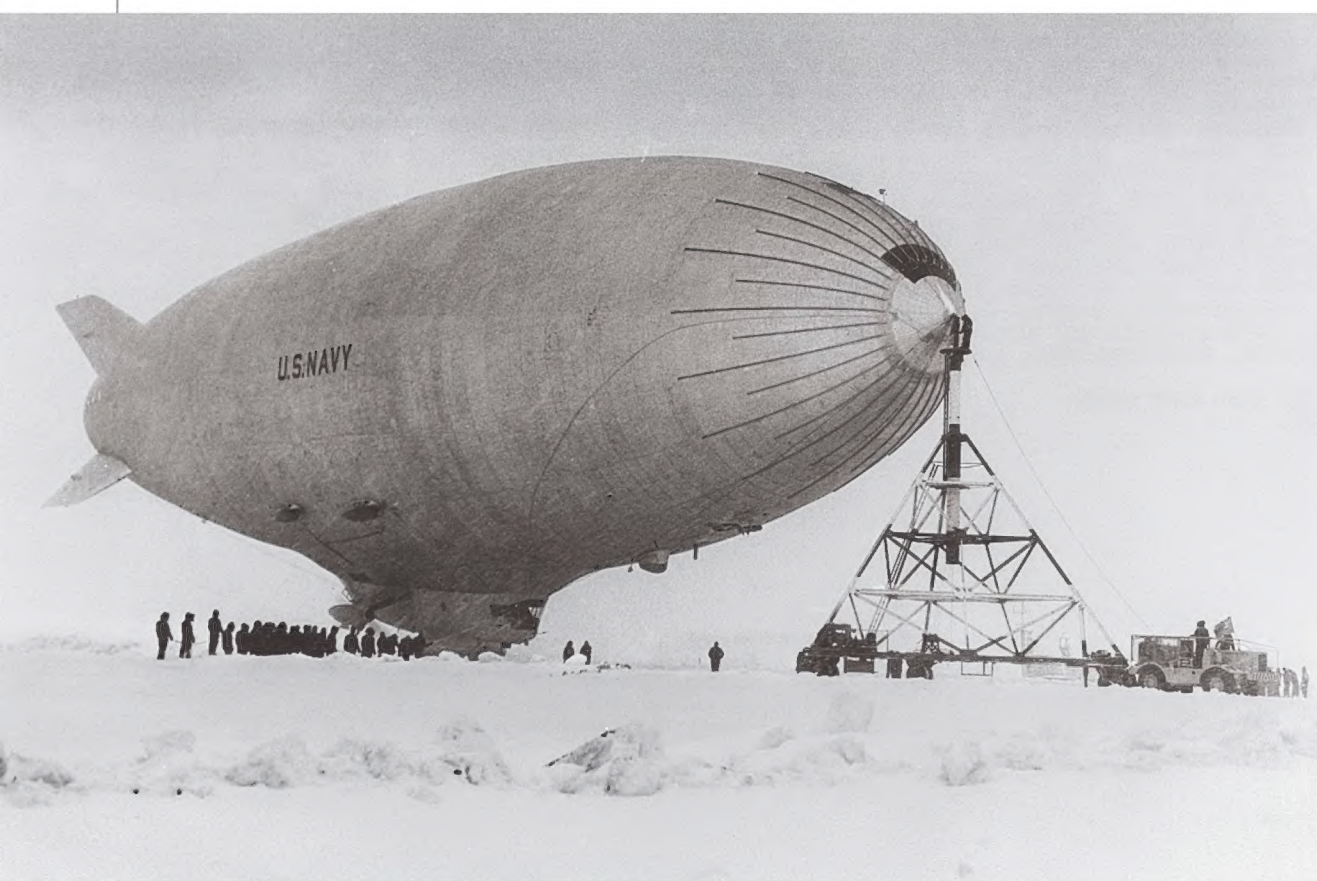
enough fuel to ensure they'd reach Key West.

The remarkably sophisticated *Snow Bird* was a ZPG-2 nonrigid airship, among the largest the Navy ever had built. ZPGs were designed for extended anti-submarine patrolling or as radar pickets stationed offshore to protect the U.S. eastern seaboard. A million cubic feet of helium buoyed each one, and a complex system of clutches allowed either engine to drive both propellers. ZPGs could refuel from fleet oilers (on its record trip, the *Snow Bird* didn't) and dip down to scoop up seawater as ballast to replace the weight of burned-off fuel (which it did).

The record flight was intended to show off the ZPGs' capabilities. But the big airships were doomed.

In 1962, just five years after the historic flight, the Navy shut down its lighter-than-air operations forever. Jack Hunt took the Harmon Trophy presented to him by President Dwight Eisenhower and went to Daytona Beach, Florida, to become the founding president of Embry-Riddle Aeronautical University, where he will always be a household name. Since then, the Harmon Trophy has had a tumultuous history, and many years passed with no award presented. Today, the aviator and aviatrix trophies reside in the National Air and Space Museum. The original of the aeronaut trophy was lost in Germany but later found and returned to the Smithsonian. And since the late 1990s, the NAA has presented the sole remaining active Harmon award to an aeronaut.

■ ■ ■ GEORGE C. LARSON, MEMBER, NAA



The *Snow Bird*'s record flight showed the capabilities of airships – but the Navy's lighter-than-air program was doomed.

But few would recognize the name Jack Hunt, the Navy's "blimp man." In those days, the National Aeronautic Association awarded three Harmon Trophies each year, for outstanding aviator, aviatrix, and aeronaut (a balloon or dirigible pilot). Hunt, the unknown aeronaut, won it for setting a record that has never been surpassed. On March 4, 1957, he and a crew of 14 took off in a U.S. Navy

the evening of March 15. The *Snow Bird* had been aloft for 264.2 hours without refueling and had flown 9,448 miles, breaking the existing marks for endurance and distance.

Like the German zeppelins under famed airship master Hugo Eckener, the *Snow Bird* flew the weather patterns and hunted for tailwinds. At one point in its flight, headwinds on the southerly track that the blimp took to find the trade winds made the crew wonder whether there was enough fuel to complete the flight. By shutting down one engine, they saved

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